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The Chemical Age

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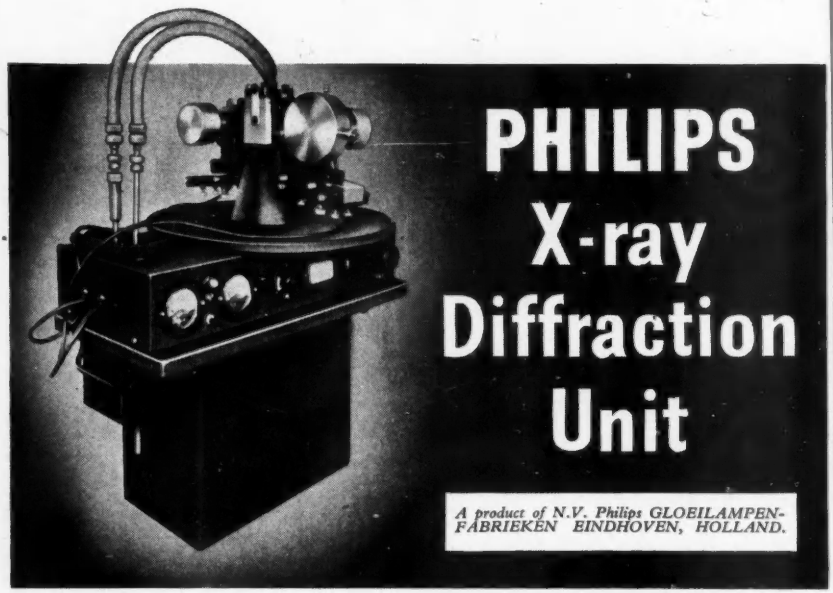

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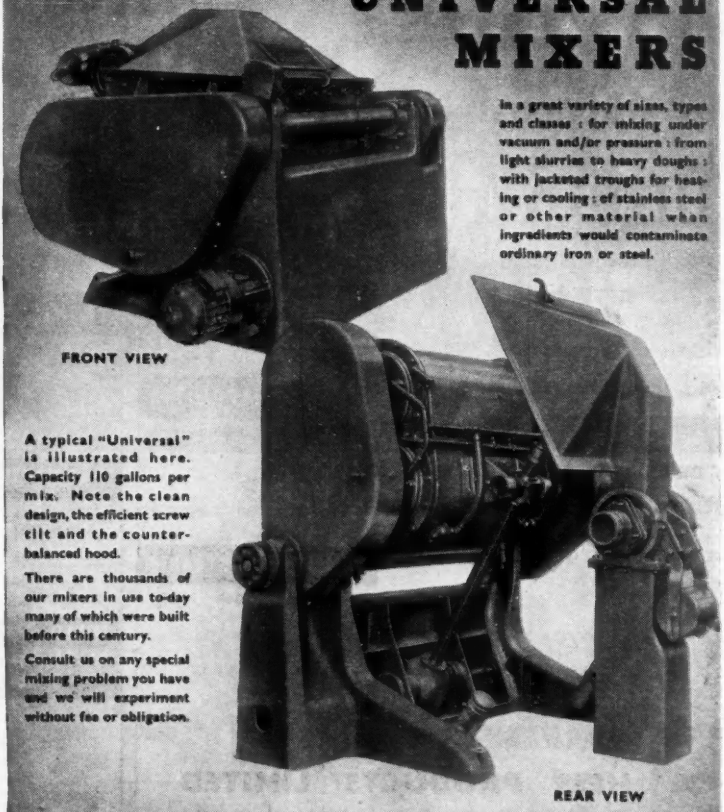

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INDEX TO ADVERTISERS IN THIS ISSUE

	Page
Altrincham Jute, Ltd.	xix
Baker Perkins, Ltd.	ii
Barbet, Ltd.	xi
Braby, Fredk., & Co., Ltd.	xii
British Electrical Development Association	vii
British Iron & Steel Federation	v
Callow Rock Lime Co., Ltd.	Cover iii
Classified Advertisements	xvi, xvii, xviii & xix
Electrothermal Engineering	xi
Farnell Carbons, Ltd.	xx
Fielding, T. H., & Sons, Ltd.	xx
Geigy, Ltd.	xii
General Asphalte Co., Ltd. (The)	xi
Guest Industrials, Ltd.	viii, xix
Hess Products, Ltd.	i
Holmes, W. C., & Co., Ltd.	vi
Imperial Smelting Corporation (Sales) Ltd.	Cover iv
Jackson, E., & Co.	xix
Jobling, James A., & Co., Ltd.	viii
Kaylene, Ltd.	Front Cover
Kestner Evaporator & Eng. Co., Ltd.	iv
Kilner, John, & Sons (1927), Ltd.	xx
Laporte Chemicals, Ltd.	iii
Leda Chemicals, Ltd.	xx
Lennox Foundry Co., Ltd	xx
Marchon Products, Ltd.	xiii
Metway Electrical Industries, Ltd.	iv
Mirvale Chemical Co., Ltd.	vi
Mullard, Ltd.	vi
National Enamels, Ltd.	xix
Nordac, Ltd.	xiv
Nu-Swift, Ltd.	xx
Philips Electrical, Ltd.	Cover ii
Pott, Cassels & Williamson	ix
Prodorite, Ltd.	Cover iii
Pulford, H., & Co., Ltd.	xx
Pulsometer Eng. Co., Ltd.	xiv
Reads, Ltd.	849
Robinson, F., & Co., Ltd.	847
Scientific Glass Blowing Co., Ltd. (The)	xix
Spencer Chapman & Messel, Ltd.	x
Staveley Iron & Chemical Co., Ltd. (The)	x
Watford Chemical Co., Ltd. (The)	xx
Worcester Royal Porcelain Co., Ltd.	Cover iii
Yorkshire Engineering & Welding Co. (Bradford), Ltd.	xv
Yorkshire Tar Distillers, Ltd.	xv

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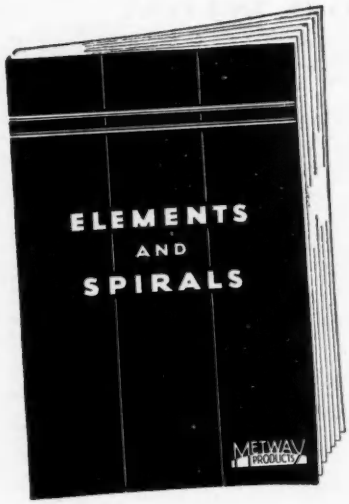

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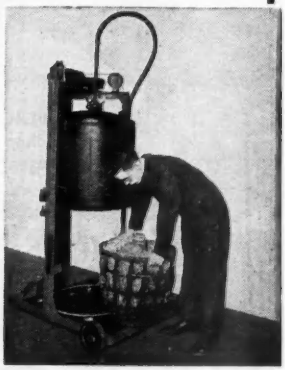

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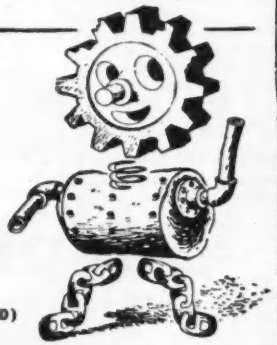

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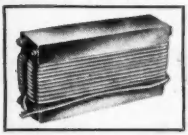

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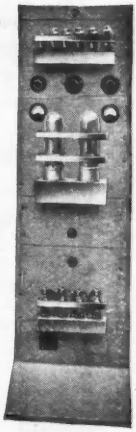

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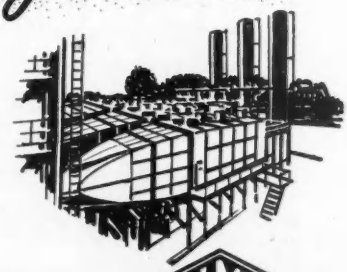

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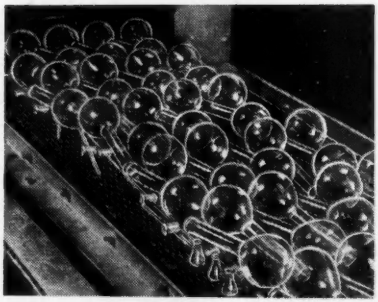

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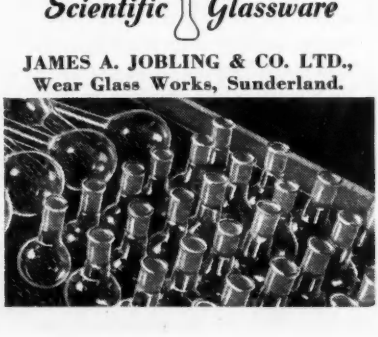

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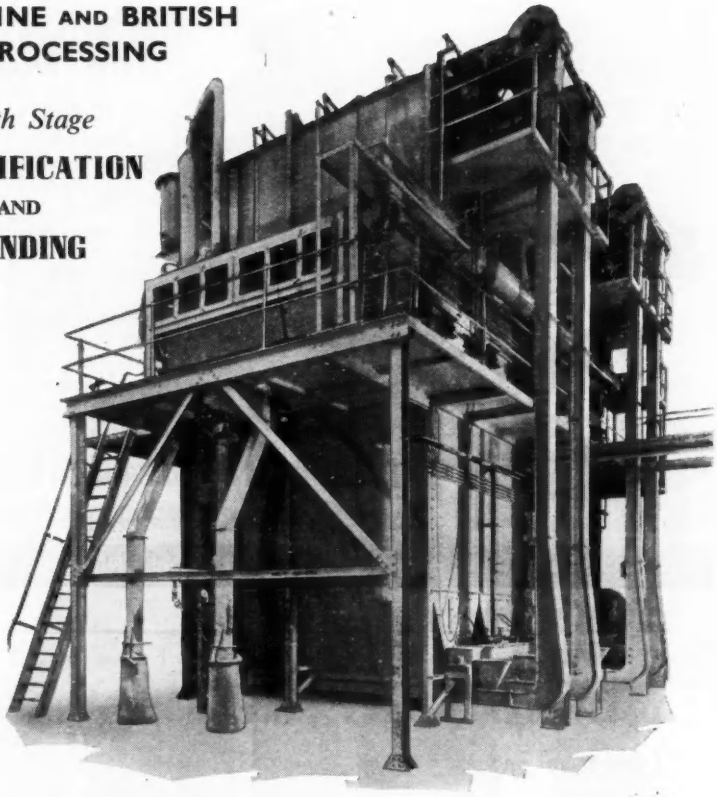

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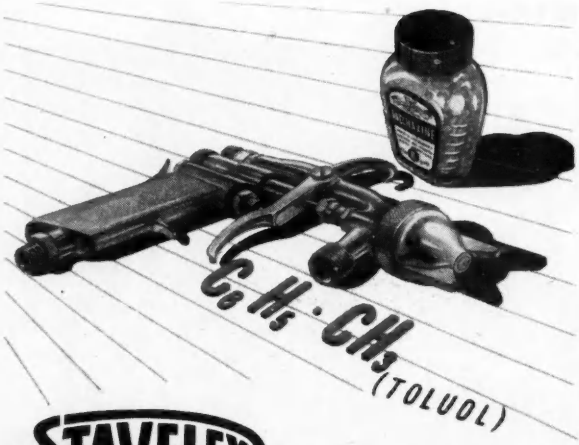

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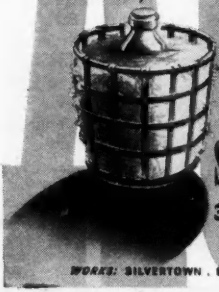

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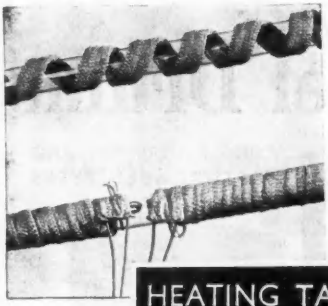

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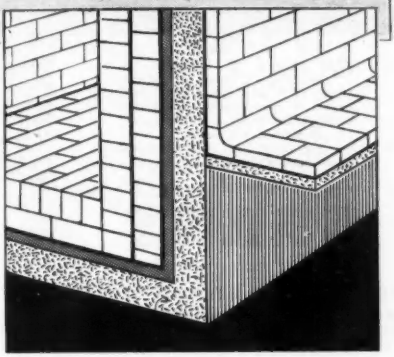

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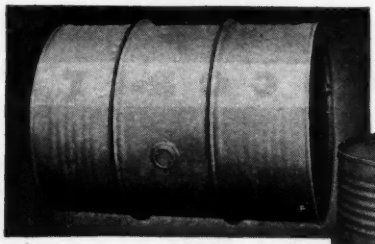

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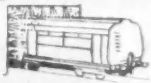
For the formulation of compounds for washing cars **and trains**  **and even buildings** **for the preparation of glass-cleaning detergents for dairies, hotels etc.** **for cleaning, treating or pickling metal in alkaline or acid solutions** **for wetting textile fibres** **washing fruit and vegetables** **for agricultural sprays** **and insecticides, for packing as a synthetic detergent as such** **or for compounding with great ease into detergent and scouring powders** **the ideal base for every type of detergent is ....**

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The
Chemical Age

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Chemistry and Christmas

SHOULD there be any other topic, even in the relatively austere pages of a scientific journal, than Christmas itself for the last leader before the 25th? Perhaps to insist today upon this seasonal homage is old-fashioned but there are surely worse modern faults than sounding echoes from the solid and sentimental Victorian past. Then, indeed, Christmas was in every sense a feast with only scoundrels and villians observing it casually or not at all; and with Christmas 'numbers' cascading out of Fleet Street to make sure that no one could put forward ignorance or absent-mindedness as an excuse for seasonal non-compliance. Even so, it is no easy task to bring Christmas and chemistry tidily together, perhaps because Christmas defies analysis and chemistry rarely begins until analysis has been attempted. The old-fashioned Christmas—and let it be hoped the modern one as well—is a natural polymer of man's virtues and the old saying that it comes but once a year shows that we cannot synthesise it.

There are, of course, many chemical contributions to the trappings of Christmas. The explosives industry must totally provide quite a tonnage of material to ensure that crackers actually crack. Ammonia and carbon dioxide and other refrigerant chemicals play a big part in making it possible for so many birds to be cooked and eaten on one particular date in the year; and in America, if not yet here, penicillin, aureomycin and the rest have made it easier in 1951 for farmers to provide weightier birds for family tables. But the chemist must keep quiet on these occasions, for the spirit of Christmas is essentially simple and not to be alienated by informative dissertations on chemistry's invisible presence. Only later in the seasonal proceedings may the chemist venture to declare his professional interest and then only on request for information as to the best kinds of alkaline carbonates or mixtures thereof. But in all probability statistics, were they available, would show that the alkaline earths make their greatest contribution to man's biochemical year on Boxing Day. This, indeed, is an aspect of Christmas that compels us to look back with awe at the Victorians. Was it only their tables that groaned? It is true that they had bismuth and bicarbonate, but acetylsalicylic acid was not theirs for universal remedy.

How did they do it—with so much less help from chemistry yet with so much more needed? Perhaps the answer is to be found in their great faith in magnesium sulphate.

It is one of our fond assumptions—though, like most of the fond variety, totally unfounded in fact—that the Victorians always had white Christmases. The Christmas card artist who paints a stage-coach without snow-laden roads and scenery must soon seek some other occupation. Here at any rate chemistry can now give the modern age a better Christmas for isobutyl methacrylate is making quite sure that American families can enjoy a white 1951 Christmas indoors even though the clerk of the weather may fail to arrange one outside. A New York company with the direct but delightful name of Make It Snow Inc. has taken the press-button aerosol can, the propellant liquid 'Freon', and plastic granules of isobutyl methacrylate, and turned this technological trinity into a domestic snow-sprayer. Nor, it seems, are Make It Snow Inc. the only indoor chemical meteorologists—quite a number of companies are entering the domestic snow business and a recent estimate suggests that they will share three million dollars of new business for their first Christmas. For just under one dollar the American parent can buy a six-ounce aerosol can to dispense enough snow to cover a 5-6 feet sized Christmas tree. These entirely new snow-dispensing cans are said to sell themselves and it is perhaps a sad reflection of our times that nothing prevents every American family from having a white Christmas except the rearmament-caused shortage of the propellant 'Freon'.

But in case we are able to add isobutyl methacrylate to our own festive properties for Christmas, 1952, let no more be said meanwhile; for this must be chemistry without explanations and even plastic snow granules from a can are entitled to their brief day of belief. There, possibly, is the secret of Christmas's reality for Western mankind. All the rest of the year the remorseless laws of life dictate the tune we live by—economics, dynamics, physics, and even the equations of our own subject, chemistry, all their laws and bye-laws must be obeyed and none winked at without dire consequences. Then for a few hours we rest in an oasis of benevolent illusion, the rules and the regulations are temporarily suspended, and we persuade ourselves that man controls his own nature and the world's equilibria much more than in fact he does or ever can. And even the most rational, objective, and sceptical chemist—if he, too, gives his mind a holiday from discipline and habit—will find himself strangely refreshed.

On Other Pages

Chemical Engineering Research . . 823

Lead as a Contaminant of Food . . 827

Work of the British Association of Chemists . . 831

Prototyping of Chemicals . . 833

Preflocculation Treatment for Industrial Wastes . . 835

Ozone Treats Phenolic Wastes . . 837

Chemicals from Petroleum . . 838

A.I.Chem.E., Elects New Officers . . 840

High Taxes Threatening Progress . . 841

Chemist's Bookshelf . . 843

Home News Items . . 845

Overseas News Items . . 846

Personal . . 847

Publications and Announcements . . 848

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Notes & Comments

Chemical Engineering Research

MOST industries today are, in a sense, chemical industries and chemical engineering is not less important than mechanical and electrical engineering in servicing them. This fact lends increased significance to the report of the special committee appointed by the Advisory Council to 'review the needs for research on chemical engineering and the extent to which they can be met by existing facilities.' It is disturbing, therefore, to find that, despite the considerable amount of work already being done, the committee considers that existing facilities for chemical engineering research are inadequate for the chemical and allied industries as a whole. Normal sectional interests of the existing research stations or industrial research associations would not permit the high priority to be given to the necessary problems if allocated to them, and the committee therefore recommends the creation of a central organisation to supplement existing facilities. The report emphasises that there is no time to wait—that there is in Great Britain all too frequently avoidable delay in the utilisation of new discoveries by our own scientists. Yet for all this urgency there is no suggestion as to how soon such a central organisation could be set up, the nature of its composition, or what its powers would be, although it does recommend that existing research centres (such as AERE, Harwell, CRL and NPL, Teddington, and so on) should make available any relevant information. Where would such an organisation best be centred, and how would it be financed? It is to be hoped that steps will soon be taken to implement the committee's recommendations and to indicate that the proposed central organisation is a practicable proposition.

American Chemical Research

FIGURES given recently by the National Research Council of America present a truly awesome picture of the present state and growth of American industrial research over the last twenty-four years. 165,000 people are at present engaged on research of one kind or another in America, in industries varying from chemical and engineering to aeronautics and electronics, and this amount represents an increase of ten times the number of research workers employed in 1927, working in three times as many laboratories (3,313). The chemical industry is, of course, the largest employer of research workers, ranking an easy first in 1950 and employing one-fifth of the total number (33,000). The biggest seven employers in this industry are apparently Du Pont, with more than 5,000 research workers, followed by Union Carbide, American Cyanamid, and Dow Chemical with 1,200 each, and Monsanto and Hercules Powder Company with nearly 1,000 each. The increase in research workers in the chemical industry, however, has not occurred steadily over the years. While the period 1927-1940 saw a 25 per cent annual expansion, the succeeding ten years saw only a 12 per cent rise—slightly lower than the rate for the whole of American industry. The same story is told in another comparison. Whereas in the ten years after 1927 the ratio of research workers to ordinary workers in any chemical firm increased by 12 per cent annually, from 1937-50 the increase was only 9 per cent per year. This slowdown in research during the '40s was

The Editor and Staff
of
THE CHEMICAL AGE
Would Like to Wish
Everyone
A Merry Christmas
and
An Enjoyable and Prosperous
New Year

probably due to the relative maturity of modern chemical industry and the fact that as the years go by more efficient methods of research and better instruments come into being and the first initial spurt given to research levels out to a more even pace. Whatever the reason, however, these figures leave no room for doubting that the rise of the chemical industry in America over the past quarter of a century has been one of the most remarkable phenomena of modern times.

IN THE EDITOR'S POST

'Silica & Silicates'

SIR,—I feel I must reply to the letter of Dr. Nutten on the above subject (THE CHEMICAL AGE, 8 December, 1951) since I cannot accept some of his remarks without qualification.

(1) I still maintain the article should have been entitled 'The Analytical Chemistry of Silica and Silicates'. It is an important difference. If I gave a piece of material to an analyst containing Si, SiO_2 and a number of metallic silicides, I should be no wiser if he gave me as answer the total Si figure calculated from the SiO_2 he had found. All the methods given in the original article dealt with the estimation of silica. Dr. Nutten says after opening out silicon containing materials by fusion, the amount of silicon present is eventually estimated. This is not so—the SiO_2 present is estimated—Si as such is rarely present. It is not true to say that one determines the sodium present in, say, potassium chloride. One determines the sodium chloride present.

(2) To my knowledge very many practising analysts are not aware that silicon attacks platinum and I do not think the author has the right to assume that his readers will have such a knowledge.

(3) The remarks in this paragraph of Dr. Nutten's letter again seem to me to assume specialised knowledge on the part of readers which is not justified. In any case, it gives no satisfactory answer for not publishing the discussions, which are the most interesting part of these meetings. The statement that a false report would result if additional material were inserted by his reporter is quite incomprehensible to me. How additional information can falsify the article is difficult to understand.

(4) I find the remarks about references completely at variance with all established practices in scientific journals. Of course all analysts can find the references for themselves if they have the time and patience to wander through an apparently endless number of journals looking for a paper by, say, Smith 1942. To impose such a task on busy analysts would only be justified if the references were not known to the author. I only hope that no other technical or scientific journal will adopt Dr. Nutten's revolutionary suggestion.

(5) It is simply not possible for geographic reasons for many analysts to attend these discussions and for this reason, presumably, publication of the proceedings is given in your Journal. It seems a pity that they should be given in so abbreviated a form when with a little extra trouble they could be made really worth-while.—Yours faithfully,

G. H. OSBORN,

Broadstone, Dorset.

Editor's note: In fairness to all concerned we feel that we should point out that the articles in question (see THE CHEMICAL AGE, **65**, *pp.* 633-637) *and all articles headed 'Midlands Analytical Methods Discussion Group' are reports of the papers presented at the meetings of the Group. These are supplied exclusively to* THE CHEMICAL AGE *by an official who gives an accurate account of the speaker's remarks. Unfortunately, it is not always possible to obtain a report of the discussion.*

The Royal Society

The following have been elected officers and council of The Royal Society for the ensuing year:—

President, Professor E. D. Adrian, O.M.; treasurer and vice-president, Sir Thomas Merton; secretaries and vice-presidents, Sir Edward Salisbury C.B.E., and Sir David Brunt; foreign secretary, Sir Cyril Hinshelwood. Other members of council: Dr. R. W. Bailey, Dr. O. M. B. Bulman, Professor P. A. Buxton, C.M.G.; Sir John Cockcroft, C.B.E.; Dr. I. de B. Daly, Professor E. O. Dodds, M.V.O.; Professor M. G. Evans; vice-president, Sir Howard Florey; Mr. P. Hall, Sir Geoffrey Jefferson, C.B.E.; Professor E. J. Maskell, Dr. W. G. Penney, O.B.E.; Professor H. H. Plaskett, Dr. R. Stoneley, Professor A. R. Todd and Professor J. Z. Young.

Chemical Engineering Research

Facilities Inadequate for the Industry

INADEQUACY of the existing facilities for chemical engineering research available to the chemical and allied industries was the first conclusion of the 'Report of the Committee on Chemical Engineering Research', published last week by the Department of Scientific and Industrial Research (HMSO, 1s. 6d.; 40 cents U.S.A.).

The committee was appointed in April, 1949, by the Advisory Council, and consisted of ten members, with Mr. H. W. Cremer, C.B.E., M.Sc., F.R.I.C., M.I.Chem.E., M.InstF., as chairman. Its terms of reference were: 'To review the needs for research in chemical engineering and the extent to which they can be met by existing facilities'.

In order to obtain the widest possible information it was decided to circulate a questionnaire, the form of which is given as an appendix to the report.

Replies received, which represented the majority of the important chemical and chemical engineering firms and allied interests, formed the basis of the committee's discussions and helped to formulate its conclusions.

Basis of Chemical Engineering

Chemical engineering, states the report, is based on the physical sciences and is concerned with the development, the design and the operation of plants in which materials undergo a change in properties. Its applications are not restricted to those industries in which chemical reactions are utilised, but extend to almost every industry. It is now appreciated that most industries, in a sense, are chemical industries and that chemical engineering is not less important than mechanical and electrical engineering in servicing them.

It is essential at the outset to realise the difference between chemical engineering and chemical technology: the distinction is important and should be clearly appreciated.

In chemical engineering approach to the task of applying scientific knowledge to industry is of a generalised character: the principles are all applicable to a wide range of special technologies. The special technologies are concerned with the *processes* of manufacture of *particular* products; chemical engineering is concerned with the study of *plant and operations* which are *generally and widely* applicable to all industries.

Essentially the business of the chemical engineer is to design and operate industrial plant. A large part of this is the task of deciding the 'leading dimensions' of installations required for a specified rate of output. Many chemical engineers are employed to operate existing plants at conditions of highest and most efficient performance. It may also fall to the chemical engineer to have to choose suitable materials for the construction of a plant.

General Classification

In seeking to define the chemical engineering research needs of industry and the facilities available to supply them, the committee decided upon the following general classification:—

Special Chemical Engineering Subjects

(*a*) *Component and/or Phase Separation; based on Physical and Mechanical Processes*

System	*Typical Operations*
Solid—Solid	Sublimation, elutriation, sieving.
Solid/Liquid	Leaching, extraction, sedimentation, filtration, evaporation, drying.
Liquid—Liquid	Distillation, fractionation, scrubbing, centrifuging.
Liquid—Gas	Aeration, entrainment, scrubbing, dehumidification.
Solid—Gas	Electrostatic precipitation, cyclone-separation, absorption, diffusion.
Gas—Gas	Liquefaction, selective absorption.

(*b*) *Formation of New Components by Chemical Processes*

Design of plant for reaction in batch and continuous working followed by component and/or phase separations depending upon the physical operations included in (*a*).

Ancillary Chemical and Engineering Subjects

In addition to the classifications under (*a*) and (*b*) above, heat transfer, fluid flow, and size reduction, with power generation,

instrumentation and materials of construction are subjects of direct interest to the chemical engineer.

Research aspects of the above subjects for the chemical engineer are:—

(a) their mechanism;
(b) the principles underlying their integration into complete manufacturing units;
c) the design of plant necessary for carrying them out efficiently on a large scale;
(d) their economics.

Before the chemical engineer can begin his task it is essential for him to have available physical data in a form which can be easily translated into terms immediately applicable to the installation to be built.

Although there is now an extensive literature of chemical engineering, most practising chemical engineers would admit that the easily available data likely to be required are not only inadequate but fragmentary.

Publication of Research Knowledge

Many firms commented that existing research knowledge and data should be collected and published or should be readily available at some central reference. It was suggested that such a central technical bureau of information might be set up under the aegis of a suitable organisation with the backing of the DSIR. Such a bureau would assist manufacturers and plant-designing firms before they embark on lengthy and costly investigations, and would materially assist productivity. The idea was supported by the committee.

Publication of a British Chemical Engineering Handbook was advocated, while the issue of a volume or series of volumes on the principles and practice of chemical engineering was also considered desirable.

There are two distinct methods of tackling problems of plant-design: One is the 'synthetic' approach, based on an endeavour to establish by physical measurement the influence of each variable entering into the problem. The other, equally necessary, is the 'analytical' consideration, in which accumulated physical knowledge is applied to existing plants in order to trace the relative importance of the variables and to ascertain why trial and error has resulted in satisfactory operation.

Far too often the chemical engineer is in the unsatisfactory state of mind of realising from experience that the theoretical calculations are wrong, but of not knowing the reason why. It is important, therefore, that an attempt should be made to bridge the gap between the theoretical scientist and the plant designer. New factors often appear in practice which have not been taken into account in the synthetic approach to design. An example is the performance of packed towers where possible maldistribution (channeling) of the flow of the fluid media emerges as a factor of increasing importance with increase in the size of the plant.

Difficulties of functional analysis in a university chemical engineering department are appreciated but the report suggested suitable arrangements with industry might be made.

Immediate investigation is required in a number of subjects. Outstanding among them are: mass transfer; heat transfer; solid and liquid separation; size reduction; plant development; instrumentation and automatic control, erosion and corrosion; and materials of construction. In the view of the sub-committee, however, in none of these cases are adequate facilities available.

Conclusions of the committee were:—

(1) Research needs in chemical engineering are varied and insistent; existing facilities for the prosecution of such research, although by no means inconsiderable, are inadequate for the purposes of the chemical and allied industries as a whole. Research needs are of two kinds, one relating to experimental investigations designed to elucidate the mechanism of the basic operations employed in industry (for example, drying, filtering, evaporating), and the other to the provision of practical quantitative data, based upon large-scale operation, which are required for design purposes.

Analytical Approach Inadequate

(2) Whereas the first of these research needs, the synthetic approach to plant design, can be met to an increasing extent by developing the research potential in universities, technical colleges and elsewhere, facilities for the second, that is the analytical approach to plant design, are, so far as can be ascertained, inadequate. Nor does there appear to be any existing central organisation appropriate to such work which would ensure in collaboration with manufacturers, closer integration of basic research with actual operations.

(3) Striking examples can be cited of manufacturing operations which, although

having their origin in this country, have been left to other countries to develop or to modernise, with the result that they are now operated here under foreign licences or in plant either purchased from abroad or constructed to foreign designs. Functional analysis of installed plant is of such paramount importance, and its results are so far-reaching, that opportunities for carrying this out systematically cannot fail to react rapidly and advantageously in the achievement of greater industrial productive efficiency.

(4) One of the more frequent comments made referred to the delay in Great Britain in utilising new discoveries by our own scientists. Many of the older plants were developed by industrialists gradually and empirically, and these plants were often highly efficient under the conditions which then existed. The tempo of industrial exploitation of scientific research has now so vastly increased that unless design specifications and estimates for the requisite process equipment can be submitted quickly and accurately, orders for this are lost to other countries—no longer is there time to wait. Functional analysis is of no less importance in designing equipment for new processes than it is in improving plant for operating the older processes.

Central Organisation

(5) Whatever steps may be taken to extend the present diverse sources of knowledge and research, national requirements as regards chemical engineering can only be met if existing facilities for research are supplemented by a central organisation specially adapted or created for the purpose. It is not thought that the case would be met if the special problems inherent in chemical engineering research were allocated to research stations or research associations already in being, even though in a limited number of instances the necessary facilities as regards staff and equipment happen to be available. In competition with the interests and pressing needs of the respective industrial fields served by these organisations, the priority accorded to chemical engineering problems of the kind under consideration would inevitably be a low one. These and similar research centres should not be expected to meet these needs, but every endeavour should be made to confer with their staffs and to make available for the benefit of chemical engineering research such relevant information as they are able to provide in the normal course of their activities. In this connection such establishments as the Atomic Energy Research Establishment, Harwell, the Chemical Research Laboratory, the Fuel Research Station, the Mechanical Engineering Research Organisation, and the National Physical Laboratory, are especially referred to.

(6) There already exists much published research information apposite to chemical engineering proper, or to its ancillary requirements, which is either unknown to potential users or which is in obscure or unrelated form. One of the primary functions of a central chemical engineering research organisation should be to collect and interpret such information, and to distribute it in a form which is directly usable by the practising chemical engineer.

U.S. Oil Production

THE vast oil wealth of the U.S. is again emphasised by latest estimates of future production given by oil experts at the annual meeting of the American Petroleum Institute recently. By 1955, these say, production of crude oil and natural gas liquids is expected to increase to between 7,750,000 and 8,025,000 barrels daily. At the beginning of 1951 output was 6,500,000 barrels daily. Demand for 1954 is expected to be 7,500,000 barrels daily. The industry requires a margin of about 1,000,000 barrels a day to provide a cushion between supply and demand.

The U.S. now produces more than half the world's oil from approximately 25 per cent of the world's crude reserves. Demand is so great that by 1953 the U.S. is likely to be importing more than 1,000,000 barrels a day of crude oil and products, and exporting only 235,000 barrels a day. Oil production outside the U.S. will average about 5,000,000 barrels a day (excluding Russia and satellites) this year, and by 1955 this capacity will be increased to somewhere between 6,000,000 and 7,140,000 barrels daily. It has been estimated that by this time oil demand in the same areas will also have increased from a current 3,500,000 to 5,000,000 barrels daily.

Food & Physical Methods

Society of Chemical Industry Meetings

A JOINT meeting of the Society of Public Analysts and Other Analytical Chemists with the Food Group of the Society of Chemical Industry was held in the meeting room of the Chemical Society, Burlington House, London, W.1, on Wednesday, 5 December. The chairman of the Food Group, Professor H. D. Kay, C.B.E., D.Sc., F.R.S., having opened the proceedings, invited the president of the Society of Public Analysts and Other Analytical Chemists, Dr. J. R. Nicholls, C.B.E., F.R.I.C., to occupy the chair.

The meeting took the form of a discussion under the general title 'The Food Standards Issue—What Does the Future Hold?' with the following special contributions: 'Compositional Standards', by T. McLachlan, D.C.M., A.C.G.F.C., F.R.I.C.; and 'Microbiological Standards', by C. L. Heller, Ph.C., M.I.Biol.

The seventh annual general meeting of the Physical Methods Group of the Society was held on Tuesday, 27 November, in the meeting room of the Chemical Society, Burlington House, London, W.1. Mr. B. S. Cooper, B.Sc., F.Inst.P., was in the chair and 32 members were present.

The meeting was followed by the 34th ordinary meeting of the group, at which Mr. B. S. Cooper delivered an address on: 'Light Sources in Chemical Analysis and Testing'. The chair was taken by Dr. J. Haslam, F.R.I.C.

Institute of Metal Finishing

Electrodepositors Meet in Brussels

SOME thirty-five members of the Institute of Metal Finishing, incorporating the Electrodepositors' Technical Society, travelled to Belgium on 5 December last, at the invitation of the Commission Belge de l'Electro-Deposition, to take part in a joint meeting in Brussels.

Two technical papers were presented during the course of the conference. On 6 December, Dr. S. Wernick, M.Sc., F.R.I.C., F.I.M., who is honorary secretary of the Institute of Metal Finishing, read a paper on 'The Trend of Development of Metal Finishing in Great Britain, and on 7 December the party visited the Bell Telephone Manufacturing Company at Antwerp where a paper on 'Problems in our Electroplating Departments' was given by Mr. C. Van Rooy, works director of the company. Another visit was to the electroplating department of the Fabrique Nationale d'Armes de Guerre at Herstal, Liège.

On the social side, members of the Institute of Metal Finishing party were invited to an official banquet given by the Commission Belge de l'Electro-Deposition on the evening of 7 December.

Chile's First Refinery

PREPARATORY work has commenced on Chile's first refinery, according to an announcement made by the M. W. Kellogg Company, refinery and chemical engineer-contractors of New York City. It will be located ten miles north of Valparaiso.

Kellogg, awarded the contract by Empresa Nacional Del Petroleo last month for the $10,000,000 refinery, estimates that actual construction will begin under the direction of its subsidiary, Kellogg Pan-American Corporation, in about a year. The refinery, a complete 20,000 barrel-per-day plant, will employ the most modern type of combination thermal processing equipment to produce several petroleum products from either indigenous or imported crude oils.

Process facilities in the combination unit comprise crude oil distillation, vis-breaking, thermal reforming, thermal cracking, gasoline stabilisation and treating equipment for sulphur removal from fuel gas, liquified petroleum gases and gasoline.

Activities Absorbed

Monsanto Chemicals, Ltd., announces that as from 1 January the manufacturing and selling activities of its wholly-owned subsidiary company, Silicon (Organic) Developments, Ltd., will be absorbed entirely by the parent company. From this date all trading operations will be carried out under the name of Monsanto Chemicals, Ltd., and correspondence should be addressed to Silicon Chemicals Department, Victoria Station House, London, S.W.1.

Silicon (Organic) Developments, Ltd., was acquired by Monsanto in November, 1948, and is concerned with the manufacture and development of modified forms of silicate esters for industrial use.

Lead as a Contaminant of Food & Drink

Introduction of Standard Limits Proposed

COMPLETE elimination of lead from food and drink is not immediately possible but its limitation to the smallest quantities commercially practicable at the present time is recommended in the report, approved by the Minister of Food, and published last week by the metallic contamination sub-committee of the Food Standards Committee.

Lead, the report stated, was one of the most widespread and serious of the metallic contaminants of food and drink. Many foods and water naturally contained small amounts of lead; but the principal source of lead contamination was in the use of lead, lead alloys and lead compounds in food processing plant, in the piping by which fluids were conveyed and in agricultural insecticides.

Shell fish might ingest and absorb lead compounds present in sea and estuary water; and lead could be inhaled in atmospheric dust. Some of these sources were uncontrollable, but others were attributable to human agency and could be regulated.

Lead arsenate was used as an insecticide for spraying fruit trees. Contamination from this source was not of course confined to raw fruit, but was liable to occur whenever these fruits, or products derived from them, were used in the preparations of foods.

Canned Foodstuffs

Contamination from containers was liable to arise with canned foods or where lead pipes were used to convey water, beer, cider and so on. The extent of contamination of canned meats varied according to the type of container, there being a higher rate of contamination from cans with vent holes which required soldering.

Water was outside the terms of reference of the sub-committee, but nevertheless it could not ignore it as a contributor to the lead content of other drinks.

In the U.S.A. a content of 0.1 parts per million (p.p.m.) of lead in drinking water was regarded as excessive. No formal limit was recognised in this country.

Since water entered into the composition of some foods and was used in processing others, it was considered important that all water supplies should be free from lead. With supplies delivered from wells or other private sources this might involve the replacement of lead pipes by others of more suitable composition; where public supplies were used it might mean the enforcement of effective measures to remove the lead solvent properties of the water.

Chronic Lead Poisoning

Recorded instances of chronic lead poisoning were mainly associated with industrial instances. Improved conditions in factories, however, showed that the number of cases of industrial lead poisoning had been reduced from over 1,000 in 1910, to 46 in 1946 and none were recorded in 1947. Industrial poisoning was chiefly attributable to lead inhalation or absorption by the skin.

It was highly probable that lead was more readily absorbed from liquid than solid foods. There seemed little doubt that a degree of tolerance might be established, that men could tolerate more than women, and that the reactions of individuals varied within wide limits. Toxicity might be affected by the form in which the lead was ingested or by the presence of other substances in the alimentary tract capable of combining with and immobilising lead.

These considerations should, however, be heavily discounted when prescribing limits of contamination for universal application. Lead, unlike most other poisons, was stored in the body and however little was absorbed and stored there was always the danger that this stored lead might be released and produce toxic effects. Lead poisoning was often brought to light following acute infection which might result in release of immobilised lead. It would obviously be improper to rely on an individual tolerance which was not general and might be only temporary.

Daily intake of lead by a normal healthy individual had been estimated at about 0.4 mg.: of this amount, 0.1 mg. might be contributed by drinking water and rather less by inhaling dust, the remainder being contributed by solid foods. These figures were necessarily very rough approximations and the amounts ingested would be substan-

tially greater for, say, heavy drinkers and for lead workers.

Lead served no known physiological purpose. It was a serious cumulative poison in that repeated small doses, each of which was too small to produce any demonstrable effect by itself, might in course of time prove toxic. The daily amount of lead ingested was the sum of the minute quantities present in the components of the diet each of which might contribute apparently insignificant amounts but the total daily intake in the food might, in course of time, add up to a possible hazard to health.

Elimination of Lead

The only way of removing this hazard was to eliminate lead from foods and drink. It was recognised, however, that elimination was not immediately possible and the recommendations made aimed at limiting the amounts in foods and beverages to the smallest quantities which were commercially practicable at the present time. The recommendations should be regarded as provisional and subject to review periodically. In the meantime every effort should be made to eliminate lead contamination of foods and beverages by improvements in the technique of food processing and in the types of food containers, by discontinuing the use of packing and wrapping material containing lead and by fostering the use of fruit and vegetable sprays less toxic than lead compounds.

Attempts had been made from time to time to calculate the total amount of lead which could be ingested daily without toxic effect. The calculations were subject to many qualifications. The evidence available would suggest that between 1 and 2 mg. of lead could be ingested daily without toxic effect, the precise amount depending upon the length of time for which it was continued, the form in which the lead was ingested and other factors. As the consumption of 2 lb. of food containing 1 p.p.m. of lead would contribute 0.9 mg. it was clear that the limits of contamination of foods and beverages must be kept very low if the safety limit was not to be exceeded.

A large number of works dealing with lead contamination were reviewed by the sub-committee, including Monier-Williams' Summary of Investigations (Trace Elements in Food) and useful data were received from the Government Chemist, the Ministry of Agriculture and Fisheries, the Ministry of Food, Port Medical Authorities, the British Food Manufacturing Industries Research Association and from public analysts, food manufacturing firms and food trade and research associations.

In fixing limits of contamination it was found appropriate to classify foods and drinks in three categories: (1) beverages; (2) foods subject to a low contamination limit; and (3) scheduled foods which could not at present be brought within category (2).

Under beverages it was found that there was a considerable risk of contamination of beer and cider and possibly other beverages as a result of lead pipes in brewery, bottling plant or licensed premises. It was recommended that the use of lead pipes and lead containers should be discontinued in all these premises as soon as possible and, in due course, should be prohibited.

Limits recommended were: soft drinks 0.2 p.p.m.; beer and cider, provisionally 1.0 p.p.m., to be reduced within 12 months to 0.5 p.p.m.; apple juice and concentrated soft drinks 0.5 p.p.m.

In foods subject to low contamination limit a figure of 2 p.p.m. was recommended. A lower limit of 0.5 p.p.m. was desirable for all staple foods and this was already attained in the case of edible fats and refined sugar.

Recommendations for scheduled foods were as follows (in parts per million): colourings, 20; dried herbs, spices, dehydrated onions and flavourings, 10; tea, 10; phosphates of ammonia, calcium and sodium, 5; edible gelatine 7 (already prescribed); liquid pectin, 10 (provisional); canned meats and fish, 5.

Lead Content in Tea

Figures supplied to the sub-committee showed that the lead content of a large number of samples of tea drawn from imports during the years 1933-1936 revealed a degree of contamination varying from small amounts to as much as 50 p.p.m. with a few samples over that amount. In some cases the packing material used was lead foil, in others aluminium, while lead with paper lining and aluminium with paper lining were also used. The figures of lead contamination were lowest where aluminium and paper was used and highest for cases lined with lead foil.

At the present time not more than 4 per

cent of tea imported was packed in lead with paper lining and the balance either in aluminium with paper or in a special type of Kraft paper lining.

More recent figures supplied, indicated that there should be no difficulty in conforming to a limit of 10 p.p.m. This limit would of course be applied to the solid before infusion. It had been estimated that from one-fifth to one-third of the lead passed into the infusion, but in view of the very low proportion which the weight of the tea bore to the weight of the infusion, a lead contamination of 10 p.p.m. in tea would normally represent less than 0.15 p.p.m. in the infusion.

Evidence was given of the difficulty of producing liquid pectin with a lower contamination than 10 p.p.m. The lead was mainly derived from spray residues, and as about 15 tons of apples were required for the production of one ton of dried apple pomace (the apple tissue from which pectin was extracted) the lead content of the pomace was substantially higher than that of the raw apples.

Use of Pectin

The sub-committee was very concerned that at present the use of pectin to the extent of 10 per cent in the manufacture of certain jams might produce in itself a lead contamination of 1 p.p.m.

It was suggested to the makers that they should investigate the possibility of removing lead from apple pectin during the manufacture of pectin. Further information was really necessary in order to settle an appropriate limit for solid pectin.

Most of the supplies of canned meats in this country were imported, and although the South American packers supplying canned corned beef under contract to the War Office had readily co-operated with the authorities in keeping the lead content of the product to the lowest possible level, it had not hitherto been found practicable to work to a lower general limit than 7 p.p.m.

Heavy consumption of canned meat in the Army and the increased consumption of canned meat by the general public to be expected as supply conditions improve made it imperative to set the lowest practicable limit and a figure of 5 p.p.m. was temporarily recommended although the majority of manufacturers might find it difficult to conform to this limit forthwith, and consultation with the trade would be necessary before a date could be fixed for imposing a statutory limit of this amount.

Contamination from lead solder was lower in canned fish than in canned meat as vent hole cans were not used, and there should be no difficulty in conforming to a limit of 5 p.p.m. for canned fish.

In view of the fact that lead occurred naturally in crustacea and shell fish in amounts higher than 2 p.p.m., it was recommended that in the sale of any such food it should be clearly stated that any lead content in excess of the limit defined by the Order, was due to the lead natural to the fish.

It was fully appreciated that before the recommendations advocated could be implemented a considerable amount of preliminary work must be done in the organisation of analytical surveys, elimination of lead pipes and containers, search for lead substitutes, revision of factory processes and the development of simpler analytical methods of lead determination. In these circumstances it was proposed that 12 months' notice should be given before any statutory limits were imposed.

At the same time the sub-committee was impressed with the urgency, in the interests of public health, of reducing the lead content of foods and more particularly of the staple foods, of canned meat and fish and of beer and cider, and it recommended that an industrial committee should be set up at an early date to promote the machinery of research an inquiry, to review progress, to ascertain to what extent the limits proposed in the report were being exceeded and to advise on the many technical problems which would arise.

Sodium Hydrosulphite Ban

Exports of sodium hydrosulphite from the U.S. are expected to be vetted for their destination, and the chemical classed as a strategic material following investigations carried out by U.S. and Dutch authorities. These discovered that quantities of American hydrosulphite were being shipped to Rotterdam, re-labelled and sent to Hong Kong, where the Chinese Communists were acquiring it. Recent interest in this comparatively innocuous substance—it is used for bleaching textiles normally—is due to the fact that it can be used for making incendiary bombs.

Electron-Exchange Resins

Redox Reactions Possible

A NEW family of exchange resins which will exchange electrons instead of protons is reported from Yale University. In a paper presented to the National Academy of Sciences at New Haven recently, H. G. Cassidy said that the principle requirement of an electron-exchange resin was that its substituent group should be easily accessible and reversibly oxidised under a wide range of conditions. He had chosen the quinone-hydroquinone system because this was truly reversible and had been the object of much study, as well as being suitable for a wide range of chemical reactions.

To make the polymer, a vinyl group was substituted in the hydroquinone, and the polymerisation carried out after esterification of the hydroxyls with benzoic acid. Molecular weights produced varied between 50,000 and 60,000. The benzoyl groups were subsequently removed by saponification. Investigation showed that copolymers with styrene or vinyl pyridine could be produced with equal ease. Cross-linked polymers in which the full exchange capacity of the individual chains was preserved, and which were insoluble in all but glacial acetic acid, were produced.

These resins can be used for redox reactions without introducing any contaminant into the product—a vital advantage to many industrial and laboratory processes. They are also very mild—of great advantage in biochemistry and the study of enzyme systems. It has been suggested that films of the polymer may afford valuable data on the effect of redox potentials on the passage of fluids through membranes and the driving forces involved in fluid transport.

Alarm Expressed

ALARM at the growing importance of synthetics in the textile field was expressed by Mr. Colin M'Kenzie, sales director of J. & P. Coats, Ltd., when he spoke to the ISMA in Glasgow on 5 December. They faced the need to manufacture a multiplicity of synthetic threads, each best in its own field, he said. In ten years' time they might have 10, 20 or 50 synthetics all clamouring for attention.

A further danger was the fear of international domination. The synthetics were chemically based and involved mass production from high-cost capital equipment. The U.S.A., Japan or Germany might secure domination as largest manufacturers and exporters of synthetics and so place the British textile industry in a serious position.

Nitrogen Fixation

High Temperature U.S. Method

A NEW method of fixing atmospheric nitrogen—the Wisconsin process, so-called because the basic research was done at the University of Wisconsin, U.S.A.—is reported from the University. Depending on a high temperature nitrogen/oxygen reaction, the process converts the nitrogen into nitric oxide and thence to nitric acid. A pilot plant producing one ton of 60 per cent nitric acid per day is reported to have been so successful that the U.S. Army has authorised construction of a plant.

The plant consists of a square horseshoe-shaped gas-heated furnace, open end down, with a bed of magnesium oxide pebbles at the bottom of each side connected to a single air vent. By means of a valve the operator can direct the air flow to either one of the beds, at will. Air is blown into one of the pebble beds, pre-heated there to attain the highest possible temperature, and forced up round the top of the furnace to mix with burning fuel gas. This raises the temperature of the air to about 4,000°F., when 2 per cent of it is converted into nitric oxide. The mixture then passes down through the other magnesium oxide bed, which absorbs the heat so quickly that the nitric oxide is cooled before it can dissociate into its constituent elements. When the cooling bed becomes too hot, the air flow is switched to it and it becomes the pre-heater, the other one becoming the cooling bed. As the furnace heats up the cycles become shorter, the valve being changed over at a pre-determined operating temperature, until the operating time becomes steady. In the preliminary pilot plant built in 1944 one difficulty was the breakdown of the furnace materials at such high temperatures, but after eight years' research a purer form of magnesium oxide was produced which worked perfectly. The recovery system for the nitric oxide converts it into concentrated nitrogen dioxide, which is then converted into nitric acid in small water towers.

Work of the British Association of Chemists

34th Annual General Meeting in Manchester

INCREASING membership and an active and satisfactory year were reported at the 34th annual general meeting of the British Association of Chemists held at Reynold's Hall, College of Technology, Manchester, on Saturday afternoon, 15 December. The retiring president, Major R. P. Porter, was in the chair.

During the period under review the association had continued to work, within the limits imposed by its resources, in the interests of its members. Advice and assistance had also been given to many individuals in a wide variety of matters.

Membership had improved, 97 new members being elected compared with 68 in the previous year. It was once again emphasised, however, that the influence of the association in all its varied spheres was ultimately bound to be dependent on the number of its members. The importance of gaining new recruits must be realised. One member had set the excellent example of obtaining 15 new members. While this was perhaps setting too high a standard for some, it was increasingly clear that personal contact was the best method of recruitment. Let every member resolve to bring in one addition during the coming year.

Unemployment Fund

The unemployment benefit fund continued to improve. There had been a surplus of £1,531 on the year's working and the fund now amounted to £51,858. Benefits paid amounted to £829. Among those whom the fund had been able to help were a number of members over the age of 40 in apparently established positions, who through re-organisation, liquidation, and so on of the firms employing them, had unexpectedly been faced with the necessity of obtaining new posts.

An increase in the basic rate of benefit per unit (22s.) to be paid during 1951/52 had been recommended by the unemployment committee, and approved by the council, as follows:—

(1) An amount of 2s. 6d. per unit per week for each unit held for more than two years, and where the member had not been in arrears with his dues during the two years preceding the date of commencement of unemployment.

(2) A further amount of 2s. 6d. per unit per week for each unit held for more than five years, and where the member had not been in arrears with his dues during the five years preceding the date of commencement of unemployment.

Legal Aid Provided

Legal aid provided by the association had again proved the value of this service to members. One received payment of six months' salary in lieu of notice without having to bring an action. Another obtained payment of the sum of £400 in respect of arrears of salary, etc., while a third was awarded damages of £120 for breach of contract. Advice on other matters, mostly service agreements, was also sought by 12 other members.

During the year, details of 4,585 posts had been included in the weekly circular. About 70 of these were at the request of the employer concerned. Owing to the increase in the cost of postage, stationery, and so on, it had been found necessary to increase the charge to members who were not unemployed to 10s. 6d. for three months.

The London Section arranged a meeting with representatives of London Students' Societies, which was attended by about 20 representatives. BAC members were present and informal discussions took place. Much interest in the association was shown by the guests.

At the request of the local sections, the deputy secretary-accountant had visited Leeds, Derby and Liverpool, and addressed meetings of members and guests on the activities of the association. A visit to Manchester was also to have taken place, but had to be postponed.

A specially appointed sub-committee drew up a Recommended Minimum Scale of Salaries for Chemists and Chemical Assistants. Publicity was given by the Trade Press, particularly by THE CHEMICAL AGE, and as a result a considerable number of requests for copies were received from employers. The scales had a favourable reception, and a number of employers had

implemented them in one way or another. The sub-committee remained in being and the scales were being kept under review.

A number of student members had been assisted in such matters as F.E.T. Grants, Deferment of National Service, Courses of Study, and so on.

Several members, employed by the same firm, had asked the association to assist them in obtaining an improvement in their salaries, etc. After correspondence with the firm, all the members concerned, except one, obtained posts elsewhere. The member who remained with the firm, however, received an increase in salary. The vacancies were eventually filled at higher salaries, and with better conditions.

Insurance Coverage

Members were again reminded that they could obtain most classes of insurance cover at a reduced cost through the association. A number of members had made savings in this direction which were greater than the amount of their subscriptions. There were also facilities for obtaining Transferable Pension Policies.

Accounts for the year to 30 September, 1951, showed a small surplus. Recent increases in standing charges had, however, rendered it necessary for council to ask full and associate members to make a voluntary increase of 5s. in their subscriptions for 1951/52. It had also been considered necessary to ask the annual general meeting to approve an official increase of 10s. per annum in these subscriptions for 1952/53, and onwards. It should be pointed out that the association had not increased its subscription since 1943, and it was one of the very few associations which had not done so.

The Hinchley Medal, commemorating the work of the late Professor J. W. Hinchley, who was a founder member of the BAC, and which is awarded for outstanding work on behalf of the association, was awarded to Mr. Norman Sheldon, A.R.C.S., F.R.I.C.

Officers elected for the ensuing year were as follows:—

President: C. A. Wylie; *vice-presidents*: Major R. P. Porter, Norman Sheldon, G. T. Gurr, Thomas McLachlan; *hon. treasurer*: H. R. Neech; *hon. secretary*: Dr. F. W. Kay; *hon. registrar*: H. L. Howard; *trustees*: C. S. Garland, Dr. H. Levinstein and J. Wilson; *hon. editor*: Dr. J. P. Lawrie.

Section councillors elected to take office following the annual general meeting were:

LONDON: (Area No. 1) H. L. Haigh, A. W. Middleton, and H. Morris; (Area No. 2) A. J. Baker and O. Petzold; LIVERPOOL: G. C. Corbett and T. Q. Matthews; MANCHESTER: F. C. Buckley and R. Morris Robinson; NOTTS & DERBY: L. E. Puddefoot and W. J. Threadkell; YORKSHIRE: G. J. Kakabadse.

Alkyl Sulphate Detergents

WRITING in *The Lancet* (8 December, 1951, pp. 1066-1067) Dr. H. Lehmann—senior lecturer in chemical pathology, St. Bartholomew's Hospital, London—reports that alkyl sulphate detergents, though not interfering seriously with most chemical routine tests in the clinical laboratory, do interfere with prothrombin-time estimation because of their tendency to form insoluble calcium precipitates. Non-ionic detergents, however, do not interfere with it.

Dr. Lehmann suggests that if synthetic detergents cannot be avoided, a non-ionic one should be used, or all glassware washed with alkyl sulphates should be rinsed afterwards with dilute acid followed by tap and then distilled water. The use of the acid is recommended because it is washed out efficiently more easily, since remaining traces can be detected by indicators or by taste.

He advises that before accepting a non-soapy detergent it should be tested in all laboratory procedures in which it might be used.

'Frisco to Use Fluorides

LATEST of the American local authorities to add fluorides to their public water supplies is San Francisco where, by 144,000 votes to 88,000 (unofficial estimates of the poll), voters decided overwhelmingly in favour of the measure. The Citizen's Committee for the Preservation of San Francisco's Good Water attempted to prove during the preceding campaign that adding fluorides to water supplies amounted to mass medication and that it was economically unsound, but the Citizen's Committee for Fluoridation gave the results of scientific research on the effect of fluorides on the incidence of dental caries. Recently, specialists at an American Dental Association meeting said that within a year one out of five Americans would be drinking fluoride-containing water.

Prototyping of Chemicals

Art of Detecting Troubles in Advance

IMPORTANCE of translating the results of research into wsrkable industrial practice is being increasingly appreciated to-day. Although Britain has had no lack of scientific brilliance she has in the past been deplorably slow in adapting it to industry.

Prototyping of machines, instruments, and of chemicals is an essential step in this development and requires the application of a special technique if cost is to be kept low, and more important, if the lessons learnt during the process are to be correctly interpreted and applied to subsequent full-scale production.

Design and construction of prototypes and their importance to the chemical industry are discussed in 'Report' (Vol. 1, No. 6), the Occasional Bulletin for November, 1951, just issued by the Sondes Place Research Institute, Dorking, from which the following has been abstracted.

The first requirement (states 'Report') is that a prototype should perform the functions or mechanical movements expected of it. The second, of particular importance in the chemical industry, is that the materials used in the construction of the prototype should be compatible with the substances it will eventually be handling and the environment in which it will operate.

In other words, it is at the prototype stage that problems of corrosion or contamination should be foreseen and provided for. Only after these two fundamental conditions are satisfied does the designer go on to consider other points that are all more or less interrelated.

Applicable to Chemicals

Although 'prototyping' is a term generally used in connection with machinery, plant and instruments, the technique can equally well be applied to chemicals. In laboratories where long-term fundamental research is carried on, for example in the universities, it sometimes happens that important work is held up for the lack of a single compound which is not to be found in the catalogue of any chemical manufacturer. Although the preparation of such a compound might be protracted and expensive, the practical problems are not insuperable since the quantity required in the first instance might only be of the order of ten or 20 grams.

After laboratory tests have been carried out, it is frequently necessary to prepare larger batches of the new compound for field trials or for testing on a semi-commercial scale. This involves the use of plant and apparatus which is seldom found in laboratories. Even where a chemical manufacturer has the requisite plant, he is seldom willing to interrupt his normal production schedule in order to fill what may well be but a transient requirement. Moreover, chemical plant designed for regular production is seldom very flexible and it may be necessary to set up special plant to carry out the reaction.

Full-Scale Production

Should the larger-scale field or semi-commercial trials prove successful, the question of full-scale production may then arise. Although this is quite outside the scope of prototyping, nevertheless the information acquired during the latter stage may be of the greatest importance both in assessing the cost of large-scale production and also in the design of the plant to be used, and consequently the fullest records are kept of all the details of a run, so that the data is available to the chemical engineer who is eventually responsible for designing the plant.

There is also the necessity for long and careful trial of alternative starting materials and methods of synthesis, so as to secure the highest yield consistent with the lowest cost and the specified standards of purity. From this it might happen that a new method of production on a commercial scale is evolved. In short, in the making of special chemical compounds, prototyping methods are applied both to the plant or apparatus and to the process.

Prototyping may also prove of value in the estimation of costs. For example, making a prototype batch of a special chemical establishes a certain yield and quality of the final product, and the costs of maintaining these in full-scale production can, therefore, be deduced with fair accuracy.

One of the first and most important questions which arises in any prototype project is that of patent rights. It would clearly

be foolish to take even the first steps in developing any new design or method until all the relevant patent claims have been thoroughly scrutinised. This is certainly the most tedious part of the process, but it is vital.

If it is found that no prior claims stand in the way of the suggested method, then the question of whether or not it is patentable must be considered equally carefully. In this connection the independent consulting organisation can offer a most important advantage.

Patentable results achieved by industrial research associations, government departments or universities supported by public funds or their members' subscriptions, usually remain the property of those institutions. Similar results developed by an independent industrial consultant are assigned absolutely to the client sponsoring the work, without further fees, except, of course, those of the Patent Agent employed. The value of this arrangement, particularly to the smaller firm, needs no emphasis.

Prototyping is a skilled job. It is, perhaps the highest form of scientific and technical *expertise*, for it requires the exercise of a highly inventive imagination coupled with the adherence to sound practical principles.

The basic rules are common to most processes, but production of a successful prototype may require detailed specialised knowledge which can only be found among a group of men with a wide variety of scientific and technological backgrounds. These can, however, be mustered if mechanical engineers, chemists and chemical engineers work together as a team, and at Sondes Place Research Institute, where prototyping of all kinds is an important and growing activity, this team-work principle is in fact standard practice.

Leather Chemists Meet

Hear Lecture on Chrome Tanning

A MEETING of the Northampton Group was held at the College of Technology, Northampton, on Thursday, 29 November, when the chair was taken by Mr. F. W. Hancock. Dr. D. A. Plant presented a paper entitled 'Recent Advances in the Chemistry of Chrome Tanning'.

A review of recent work was given, and this included Gustavson's use of ion-exchange resins by which the existence of large proportions of uncharged complexes in chrome-tanning liquors was recognised for the first time. The application of this method in the investigation of the tanning effects of the three ionic types was outlined, and two modes of chrome combination were referred to, one by the cationic complexes reacting with carboxyl groups and the second by neutral complexes reacting with hydroxyl groups or with the peptide linkages. The results of Bowes and Kenten on the chrome tannage of methylated and de-aminated collagen were summarised; these indicated the combination of chromium with carboxyl groups and the formation of cross linkages resulting in high shrinkage temperatures.

The determination of the degree of carboxyl blockage in chrome-tanned collagen by measuring the combination of long-chain quaternary ammonium salts as a function of *p*H, was described. From a comparison between the combination curves for untreated and chrome collagen, it has been found that the carboxyl groups involved are those not present in zwitterions, but those which are unionised at the isoelectric point. These groups are produced by the hydrolysis of amide groups in liming. Owing to the reversal of tannage at *p*H values above 9, it was not possible to ascertain to what extent, if at all, the zwitterion carboxyl groups are blocked by tannage. Assuming two chromium atoms combined per free carboxyl group, it was shown that 2.6 per cent Cr_2O_3 could be combined. The postulated tannage mechanism, therefore, could result in the fixation of amounts of chrome of the order of those found in normal tannage.

After a discussion on points arising from the lecture, a hearty vote of thanks was passed to Dr. Plant, and thanks were also expressed to the College Authorities for the use of the rooms.

Speed Up on Atomic Energy Plant

One of Britain's key atomic energy centres, the plant at Capenhurst, Cheshire, has been ordered to speed up its work. Production work on a pilot plant in one section already employs 400 people—but the Government are urging the Works Ministry to press on in the national interest. About 1,800 workers will be needed when other sections start.

Preflocculation Treatment for Industrial Wastes

Combined Flocculator and Clarifier Developed

RECENT legislation has made it necessary for still greater attention to be directed to the disposal of industrial wastes. Research in Britain, the U.S.A. and other countries with serious pollution problems has led to the development of satisfactory processes for treating many types of waste liquors. Progress in this field has been facilitated by advances in chemical engineering, which have enabled technical difficulties to be overcome by the installation of plant and equipment of greatly improved design.

Important applications in the industrial field are expected for the Dorr Clariflocculator, a unit of novel type which was originally developed for sewage disposal and water treatment. This equipment was designed by The Dorr Company, Stamford, Connecticut, and is now manufactured in Britain under licence by the Dorr-Oliver Co., Ltd.

Use of chemical reagents to promote the flocculation of fine, slow settling solids is a well established practice in both sewage and water treatment. It was not till comparatively recently, however, that a research project of the Dorr Company conducted both in the laboratory and the field, showed that simple mechanical flocculation, without chemicals, had a decidedly beneficial effect on the subsequent settling characteristics of raw sewage and water.

Full-Scale Tests

The research finding was checked by full-scale tests at several field stations. Preflocculation of raw sewage, for example, was found to yield suspended solids removals of the order of 70-75 per cent., compared with the removals of around 55 per cent normally obtained in primary sedimentation tanks. It was also found that, if the suspended solid removals were held to their normal values, the capacity of a given sedimentation tank could be increased up to 35 per cent if provision was made for preflocculation.

These studies led to the development of a combination flocculator and clarifier in a single tank. Compared with a standard clarifier on raw sewage, this equipment gives either up to 23 per cent greater removals of suspended solids or up to 35 per cent greater capacity. In commercial operation removals up to 70-80 per cent have been attained in certain circumstances, usually with strong sewages. By the addition of chemicals removals well over 70-80 per cent can be achieved, or alternatively capacity can be correspondingly increased.

Design of this unit is based on well demonstrated principles of hydraulic flow and physical chemistry. The Dorr Clariflocculator is installed in a special round tank, divided by a circular baffle into an inner circular compartment and an outer annular one. Feed enters centrally through an inverted syphon, overflow is taken off peripherally across a continuous circular weir, and settled solids are removed from a central depression in the bottom of the tank.

Rapid Flocculation Mechanism

A special mechanism is installed in the central compartment to promote more rapid flocculation of the raw solids to heavy, dense agglomerations having greatly improved settling qualities. A portion of settled floc is subsequently returned to this compartment to provide nuclei for the formation of new floc growths. The moving elements are a series of rotating, wedge-shaped, vertical paddles. In their travel they intermesh repeatedly with correspondingly fixed vertical paddles suspended from the transverse beams. The net effect is a gentle controlled agitation in the flocculation zone, which gives the raw solids the maximum opportunity to impinge upon one another and grow to heavy, dense formations.

The well flocculated solids pass quietly into the outer annular compartment where continuous sedimentation takes place. Here a mechanism is installed to rake the settled flocs to the central discharge department. A distinctive feature of the unit is the fact that the transfer of floc from the flocculation to the sedimentation compartment is so gentle that the flocs are not disintegrated nor are their settling qualities impaired.

Besides being more compact than the conventional combination of flocculators and

clarifiers in separate tanks, the new type of unit is also claimed to be more efficient. The volume and area provided are the same as for an individual clarifier for the same duty, exclusive of the volume and area of the flocculator, which would also be required in a separate tank installation.

The Dorr Clariflocculator is applicable to all fields now served by the continuous sedimentation units, including both raw wastes and chemically treated wastes. The first two units introduced to Britain were installed during the war for the treatment of waste liquors in ordnance factories, and one or two commercial installations are already in operation.

Palestine Potash Pact

Operations May Commence Soon

ANNOUNCING that a tentative agreement on the Dead Sea potash works has been reached between the Israel Government's inter-ministerial committee studying the problem, and the directors of Palestine Potash, Ltd., Mr. Eliezer Kaplan, the Israel Minister of Finance, last week stated that operation of the plant's southern works may be resumed by next April. Further meetings are scheduled to work out a number of details. The agreement in principle, which was initialled in Jerusalem, is subject to the approval of the Israel Cabinet and of the company shareholders (our Tel Aviv correspondent reports).

Although acceptance by both parties is expected, the Government and the company have agreed to keep the details of the agreement secret. The agreement follows a week of meetings although negotiations have been in progress for many months.

The agreement reportedly provides for the establishment of a new company with the Government controlling at least 51 per cent of the shares. Palestine Potash, Ltd., and other interests, including possibly Israel public institutions and other investment corporations, are expected to subscribe the remaining 49 per cent.

Another clause in the agreement is said to give the Government a guarantee that it will always have the right to name a majority of the new enterprise's board of directors. This point would give the Government a controlling voice even if it sold some of its shares to other parties.

According to an announcement made in the Israel parliament, Mr. Kaplan, the Minister of Finance, said that about IL.600,000 will be invested by the Israel Government at the present stage to permit the resumption of work. This is about half of the amount allocated by the Israel authorities for the development of its southern desert area, the Negev.

Capable of producing about 100,000 tons of potash yearly, the plant on the south-western shore of the Dead Sea has been idle for more than three years. A small staff, however, has kept the machinery in good working order. When work is resumed, one of the biggest tasks will be to clean up the plant area and to effect repairs on the pipeline supplying water. Much of the pipeline is smashed and parts of the internal miniature railway are missing. In addition, a large amount of semi-refined potash is lying in the canals and evaporation pans. This could be refined fully and packed. But shipment will have to await completion of a new road from S'dom, where the plant is situated, to Beersheba, the only big town in the desert. The new road is supposed to be ready by the middle of next year. The plan is to haul the potash by truck to Beersheba and on to Migdal Askalon—a distance of 135 kilometres—and thence by rail to the northern port of Haifa.

Work is also to begin on the remodelling of the plant with modern equipment, some of which is already in storage in Haifa and some on order in the U.S.A. Expansion plans call for annual production of about half a million tons. Before this can be done, additional sweet water sources will have to be found—or provided—in the area.

First National Exhibition

New technical equipment for refrigeration and preservation will be on view at the National Ice Cream Exhibition to be held at the City Hall, Manchester, from 29 January to 2 February. This will be the first occasion on which a show in the United Kingdom has been devoted exclusively to the ice cream industry.

'Chemical Trade Journal'

It has been drawn to our attention that the telephone number of *The Chemical Trade Journal* shown in the Chemical and Metallurgical Journals Section of the 1952 CHEMICAL AGE YEAR BOOK should read Whitehall 1873 and not Holborn 3361.

Ozone Treats Phenolic Wastes

American Coke Plants Interested in Process

THE use of ozone for treating phenolic wastes in coke plants in America has recently been found to be not only efficient but cheap, reports *Chemical Engineering*. Steel plants in the Ohio River Valley are considering putting in ozone systems to treat the waste from their coke plants, and the petroleum industry is also reported to be interested in the process.

The pilot plant trials were carried out by the Armco Steel Corporation at its by-product coke plant in Hamilton, Ohio. The pilot plant was set to work on a dephenolised ammonia-still effluent containing a phenol concentration (as mono-hydroxy benzene derivatives) of 28-332 p.p.m. Chlorides were present at 7,000-9,700 p.p.m., ammonia up to 2,390 p.p.m., and the biochemical oxygen demand was 300-400 p.p.m. Temperature from the still was 212°F. and the *p*H of the waste was usually above 11. The pilot plant was designed to handle a continuous flow of 2 gallons per minute or a batch of up to 350 gallons, and its holding tank held 1,000 gallons.

The reactor was a tower 18 ft. high and 2 ft. in diameter, constructed so that the liquid depth could be varied at 2 ft. intervals. Ammonia-still waste was pumped from the steam-heated holding tank, through a rotameter and into the top of the reaction tower. Ozonised air from the ozonisor was fed into the bottom of the tower through a stainless steel diffuser tube and the treated effluent was drawn off just below this tube. Ozone was generated by an ozonisor at the rate of 0.5 lb. per hour.

Batch Treatment Best

As a result of these tests, it was found that only 600 p.p.m. of ozone reduces the phenols to less than 1 p.p.m., but it needed 1,000 p.p.m. or more to reduce them to .005 p.p.m., the limit of taste. Batch treatment was found to be more efficient (and probably cheaper in the long run) than continuous operation, as there was no violent mixing of the effluent that diluted the incoming waste with partly oxidised waste. Pure phenol required less ozone than the effluent phenol, since ammonia-still waste has other oxidisable materials in it. Best results were obtained when the *p*H of the waste was 11.5-12.8.

The average reduction in the chemical oxidation demand of the waste was 0.7 parts per part of ozone, and biochemical oxygen demand was reduced by about 60 per cent. No serious foaming developed at temperatures as low as 43°C., although it did develop if the waste was allowed to cool to ambient temperature. Ammonia content of the waste was found to have little or no effect on ozone treatment.

Instantaneous Reaction

Reaction appeared to be instantaneous, but contact time had to be considered in plant design since the ozone was added as a 1-2 per cent gaseous solution. However, partial treatment did not produce chlorophenols as do chlorine products; the ozone-phenol reaction products were actually less objectionable than phenol itself. Moreover, residual ozone could be controlled to less than 1 p.p.m. and required no after-treatment. Laboratory studies so far indicate that other types of phenol-containing wastes such as those from synthetic phenol plants, phenolic resin plants and petroleum refineries would respond to similar treatment.

An important asset of this ozone treatment is its cost. This naturally varies with different plants, but while installation costs for chlorine or chlorine dioxide systems would be quite a bit less than an ozone plant, running costs for chlorine have been estimated to be 2-3 times and for chlorine dioxide 6-8 times higher than those for ozone. Both of these reagents, moreover, require higher quantities of the oxidising agent. It is estimated that the low operating costs of ozone would offset the higher initial cost within 2-5 years.

Of this, the ozone-producing equipment itself accounts for 95 per cent. The total electrical energy required to produce the ozone is 10-12 kWh per lb. of ozone when air is used. This drops to 6 kWh when oxygen is used. All in all, total cost of treating coke plant phenolic waste with ozone has been estimated to be about one dollar per 1,000 gallons of waste.

C

Chemicals from Petroleum

AROMATIC and olefinic chemicals have in the past had to be supplied from widely differing sources—from coal tar, by the cracking of petroleum gases and, indirectly, from fermentation. One of the numerous benefits resulting from the full-scale production of petroleum chemicals at Partington, near Manchester, by Petroleum Chemicals, Ltd., is that almost the whole range can be supplied from one material and one location in a very high degree of purity.

Caterole Process as Basis

This British-designed and engineered project—based on the Catarole process—occupying a 120-acre site, comprises a series of plants working in co-ordination to produce a wide range of chemicals. The whole project was developed, designed, engineered and erected by the associated company, Petrocarbon, Ltd.

Situated alongside the Manchester Ship Canal, the position gives excellent facilities for transport by road, rail and waterway.

Lay-out is rectangular in form with all services radiating from a central block of buildings in which are situated steam and power generating plants, engineering workshops, stores and so on. From the raw feedstock to the finished product, all materials—gases, liquids and solids—flow smoothly through the various stages, with emphasis on safety and ease of handling.

Full use has been made of modern techniques in automatic control, instrumentation and mechanisation resulting in a high degree of productivity per industrial worker. Each process worker, for example, is responsible for an average of £10,000 capital value of plant. The plants run 24 hrs. a day for 7 days a week, with continuous supervision.

Cracking plant consists of five self-contained Catarole cracking units, any four of which are continuously handling the necessary throughput.

Main features of the cracking process are: ability to use, as feedstock, a wide range of petroleum distillates boiling below 300°C.; control of product quality by virtue of furnace design and individual tube control; and simultaneous production of liquid with a high concentration of aromatics, and a gas with a high concentration of olefins.

The purified cracker gas is separated by distillation at low temperatures into hydrogen, methane, ethane, ethylene, propane, propylene, butanes, butylenes and butadiene.

In the ethylene oxide plant, ethylene, which has been isolated in the gas separation plant, is converted to ethylene oxide by the 'chlorhydrin' process. The ethylene is reacted with water and gaseous chlorine to produce ethylene chlorhydrin solution, which is 'saponified' by reaction with alkali to produce ethylene oxide.

Production of chlorhydrin solution takes place in a series of large, vertical, acid-resisting towers where water, ethylene and chlorine are interacted continuously. Ethylene oxide is removed by steam distillation and is finally purified by fractional distillation in a plate column.

Ethylene oxide is a volatile liquid (boiling point 51°F.). Special care is taken in its manufacture and it is stored in the absence of air in refrigerated tanks. 1:2-dichlorethane and dichlorodiethyl ether are also important products of this process.

Ethylene Glycols Plant

Operation of the ethylene glycols plant is based on the interaction of ethylene oxide with water in the presence of an acid catalyst. Monoethylene glycol and higher glycols are obtained as products.

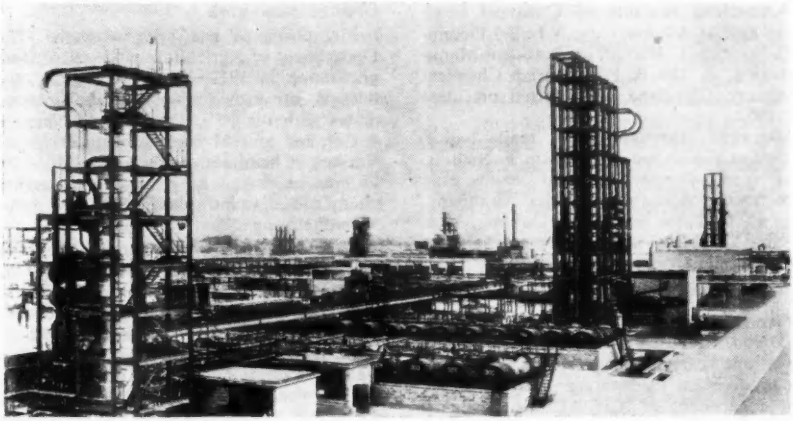
The ethylene oxide derivatives fall into two main groups: ethanolamines and the glycol ethers.

Liquid product from the Catarole cracking units passes to the primary distillation plant and is there split up into convenient fractions for further treatment. The plant is capable of operating under either atmospheric or vacuum conditions.

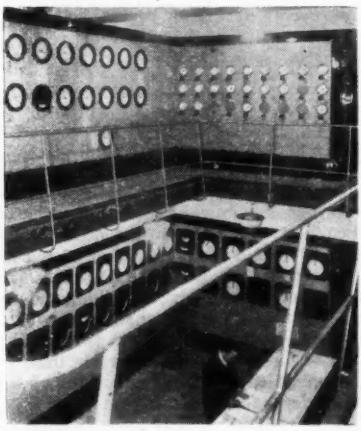
Lighter fractions from this plant pass to a re-run distillation unit which is arranged to run in two operations. In the first operation benzene and toluene fractions are the main products; in the second, an *m*- and *p*-xylene fraction, a mixed *o*-xylene and styrene fraction and an alkyl benzene-indene fraction are produced.

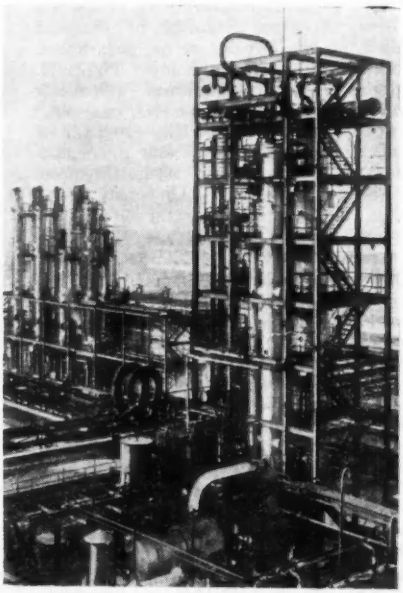
Novel features both from the point of view of process and construction materials are contained in the resin plant which produces a high quality hydrocarbon resin from the alkyl benzene fraction.

Wide Range of Products at Partington



Three photographs from the series of striking pictures reproduced in 'Petroleum Chemicals,' the latest booklet describing its plant at Partington, near Manchester, recently published by Petroleum Chemicals, Ltd. (printed by Gale & Polden, Ltd.). The section of the 120-acre works seen above shows (left) the distillation plant which produces important high boiling point solvents, and (right) the re-run and azeotropic distillation units





Part of the ethylene oxide plant (foreground) and the ethylene oxide derivatives plant. Left: A corner of the control room of the gas separation plant

A.I.Ch.E. New Officers

Chosen from Academic & Industrial Fields

AT THE 44th annual meeting of the American Institute of Chemical Engineers held at Atlantic City, N.J., 2-5 December, William I. Burt, Vice-President-Manufacturing, of The B. F. Goodrich Chemical Company, Cleveland, was elected president for 1952.

Members, through their mail ballot, elected as vice-president, William T. Nichols, who is a director, general engineering department, Monsanto Chemical Company. Stephen L. Tyler and C. R. DeLong, both of New York City, were re-elected executive secretary and treasurer respectively.

Five New Directors

Five new directors were chosen. William T. Dixon, of Philadelphia, Pa., was elected for a one-year period. He is manager, design division, engineering and construction department of The Atlantic Refining Co., Philadelphia. Four others were elected to serve for a three-year term. They are J. Henry Rushton, professor of chemical engineering and director of the department, Illinois Institute of Technology; Philip H. Groggins, chief, Agricultural Chemicals Section, Chemical Division, National Production Authority; J. C. Elgin, professor of chemical engineering, chairman of department and Associate Dean of the Engineering School, Princeton University; and Arthur K. Doolittle, assistant director of research, Carbide and Carbon Chemicals Company, South Charleston, West Virginia.

The new president, William I. Burt, has been with the B. F. Goodrich Chemical Co. since 1927, and was, prior to his position as vice-president, the superintendent of production of the chemical division, and manager of chemical manufacturing division.

Mr. Nichols, the new vice-president, has been with Monsanto Chemical Company as director of the General Engineering Department since 1949. Prior to that he had been with Westvaco Chlorine Products Corporation since 1930, becoming technical assistant to executive vice-president in 1943.

Professor Rushton is also a consultant and director of research for Mixing Equipment Company. From 1942-1946 he served as Technical Aide and Chief of Section 11.1 for the Office of Scientific Research and Development, NDRC. He is also a member of American Chemical Society, Society of Chemical Industry, American Society of Mechanical Engineers, American Society of Engineering Education, and the Chemists' Club of New York.

Mr. Groggins has been with the U.S. Department of Agriculture since 1926. Upon graduation in 1912, he worked in the production of acids, explosives and intermediates with the E. I. Du Pont de Nemours & Co., and in 1921 became manager for the Veribest Chemicals, Inc. From 1921-1925 he was in charge of *p*-nitroaniline and *p*-phenylene diamine plants for the Tower Manufacturing Co.

Professor Elgin was a section member, official investigator and consultant to the National Defence Research Committee from 1940-1942 and for the latter two years he also was Chief of the Polymer Equipment Development and Polymer Development Branches, Office of Rubber Director for the War Production Board. From 1944-45 he was an engineering assistant to Associate Director, Division Chief and Consultant to the S.A.M. Laboratories, Manhattan Project, Columbia University. He was chairman of the Section on Industrial and Engineering Chemistry for the Twelfth International Congress of Pure and Applied Science.

Mr. Doolittle, assistant director of Research at Carbide & Carbon Chemicals Corp., has been with this company since 1932, and prior to that was employed by The Dorr Co., Sherwin-Williams Co. and Bradley and Vrooman Co. He has authored about twenty technical papers and thirty patents, mostly in the fields of solvents, plasticisers, resins and surface coatings.

Royal Visit to BCRA

The Duke of Edinburgh visited Stoke-on-Trent on 12 December when His Royal Highness opened the new laboratories of the British Ceramic Research Association at Penkhull. Referring to the need for the rapid and continuous application of scientific research to industry, the Duke in his address declaring the new buildings open, said that the association had made many important improvements in refractory materials for ovens as well as for the furnaces on which the heavy industries of the country depended.

High Taxes Threatening Progress

American Engineer Believes Britain Faces Stagnation

CURRENT tax laws are preventing many new tools of production, now in the laboratory stage of development, from being exploited and are thus halting the creation of numerous new industries, C. G. Kirkbride, vice-president and director of Houdry Process Corporation and winner of the 1951 Professional Progress Award sponsored by Celanese Corporation of America, declared before the American Institute of Chemical Engineers at Atlantic City, New Jersey, on 4 December.

Unless America's tax structure was changed radically so that it did not destroy incentive, the time would soon come when very little research and development could be justified. No one would spend money on research and development if the product could not be justified because of the tax laws. It it were not for the hope that lawmakers would soon recognise their errors and correct the adverse features of the tax structure industrial research and development budgets would be only a small faction of their present size. The incentive for research and development and the competition between private research and development organisations must not be hindered in any way. America had a technological economy and nothing should be permitted to discourage its progress.

Lowered Living Standards

Mr. Kirkbride cited Great Britain as an example of a country which has suffered a lowering of living standards through a failure to adopt technological improvements of productive machinery.

'There is no question but that the differences in productivity per worker in Britain and the United States is primarily a result of the difference in the extent and efficiency of their respective tools of production,' he said.

'I am convinced that the basic reason for her (Britain's) failure is an unsound attitude or philosophy caused by a lack of competition and individual incentives. The symptoms of her disease were manifesting themselves during the height of prosperity between 1860 and 1870. Between 1870 and 1900 the symptoms became more apparent. Those symptoms to-day are open sores and can be cured only by a radical change in attitude. Pouring billions of American tax payers' dollars into Britain certainly is not the cure. I think everyone will agree with me that to-day in the United States we have many of the symptoms that were apparent in Britain at the turn of the century. An important difference however is that the disease in America appears to be developing somewhat faster than it did in Britain.

Technological Stagnation

'Britain to-day is faced with a highly advanced case of technological stagnation but there is a great deal of similarity between the symptoms of this disease in Britain as manifested between 1870 and 1914 and in the United States to-day. Over confidence, something for nothing, success their due, habit of extending leisure time, complacency toward cold facts, and a mania for security are evident in the United States to-day just as they were in Britain between 1870 and 1914. It is a disease caused by lack of individual incentive. Normally people do not want something for nothing. They really want to be useful.'

British Economic Position

In speaking of the British economic position, Mr. Kirkbride stated that the Tory Government was socialistic also, and quoted *The Economist* to the effect that '"British industrialists, under the deliberate leadership of the Tory Party in its Baldwin-Chamberlain era, have become distinguishable from the British Socialists only by the fact that they still believe in private profits. Both believe in "organising" industry; both believe in protecting it, when organised, against any competition, either from foreigners or from native newcomers; both believe in standard prices for what they sell; both united in condemning competition the one as "wasteful" the other as "destructive". If free, competitive, private-enterprise capitalism is to continue to exist, not throughout the national economy, but in any part of it, then it needs rescuing from the Socialists"'.

Sir John Cass College

Second Term Courses

CHEMISTRY takes a leading place among the courses announced by the Sir John Cass College, Aldgate, London, for the second term of the 1951-52 session.

Details of three courses under the Department of Chemistry are as follows:—

Ten lecture-demonstrations suitable for analysts and advanced students of chemistry will be given by David W. Wilson, M.Sc. (Belfast), F.R.I.C., on Tuesday evenings at 6 p.m., beginning 15 January, 1952, on 'Microchemical Analysis'. The course is designed to introduce the principles and techniques of inorganic and organic analysis on the micro and semi-micro scales.

'Absorption Spectroscopy' will be the subject of ten lectures to be given by A. R. Philpotts, M.A. (Cantab.). Practical problems of the chemist will be dealt with and the talks will be illustrated by lantern slides, photographs, charts and demonstrations. The course will be held on Friday evenings at 6 p.m., beginning 11 January, 1952.

'Principles and Practice of Distillation' for industrial chemists and chemical engineers will be dealt with by G. A. Dummett, M.A., A.M.I.Chem.E., in a series of eight lectures on Friday evenings at 6 p.m. beginning 25 January, 1952. Syllabus for the series is: 1, Basic theory; 2, Theory of the fractionating column; 3, column design; 4, plant design and operation; 5, auxiliary plant; 6, 7, and 8, distillation of petroleum, alcohol and miscellaneous products.

Under the Physics Department a special course of lectures is being given by L. A. Thomas, B.Sc., F.Inst.P. (Research Laboratories, G.E.C.), on 'X-Ray Crystallography'. Beginning 10 January, 1952, the series will be held on Thursday evenings at 6 p.m., and will consist of ten lectures.

A laboratory course on 'Solid Fuel Analysis', by S. Wald, B.Sc., will be held under the Department of Metallurgy. The first talk will be given on Monday, 7 January, 1952, at 6 p.m.

All the substantial changes made in the law by the new Patents and Designs Act will be explained by Eric Walker, M.A., B.C.L., in a series of eight lectures on 'Patents and Industrial Design Protection'. The talks will be given on Thursday evening at 6 p.m., beginning 24 January, 1952.

Canadian Potash Tests

ONE of the three largest known fields of potash in the world is being developed at Unity, Saskatchewan, by Western Potash Corp., Ltd., which at the moment, is conducting tests to ascertain the economic feasibility of production by the brine recovery method rather than by the costly manual mining.

The beds at Unity were described in 1949 by the American Institute of Mining and Metallurgical Engineers to be the most promising on the continent. This autumn, three British industrialists surveying Canadian developments visited the field and said they were impressed with its possibilities.

The deposits have been ascertained to be 11 feet thick and to extend for at least 12 miles. This would rank it as one of the three largest known in the world, along with Stassfurt, Germany, and Carlsbad, New Mexico. The others are manually mined, but because of its horizontal structure, the brine recovery method is possible at Unity and Western Potash Corporation is conducting tests to ascertain economic feasibility of such recovery.

Algae as Food

LARGE-SCALE cultivation of the unicellular algae 'chlorella,' an important source of food and industrial raw materials, has been started in a research plant at Cambridge, Massachusetts, as part of a general study sponsored by the Carnegie Institution in Washington. Cultures of chlorella—a fresh water form of algae—are grown in water in which small amounts of potassium, nitrogen, phosphorus and magnesium salts have been dissolved, and carbon dioxide and air added. A greenish fluid is partially drawn off and dried to a light powder which has been found to contain 45-50 per cent protein with 15-25 per cent fats, about 20 per cent carbohydrates and very little waste material. Greater yields per acre are indicated with chlorella than with any food plant grown in soil, it is reported. Already two foreign countries which have plenty of sunshine but little good soil are watching the experiments with interest. A number of companies are also looking into the possible industrial uses of chlorella. It is believed that it might be used for such things as drying oils in paints and varnishes, and possibly for making artificial wool.

COMBUSTION, FLAMES AND EXPLOSIONS OF GASES. B. Lewis and G. von Elbe. Academic Press Inc. New York. 1951. Pp. XIX + 795. $13.50.

This book bears the same title as a previous work by the same authors who maintain that it is in no sense a second edition of the former. The authors have attempted to survey the present state of knowledge on this subject, and have carried out their task very well.

It is divided into four parts which deal respectively with the chemistry and kinetics of the reactions between fuel gases and oxygen, flame propagation, the state of the burned gas, and problems in technical combustion processes. In the first part, the subject is treated by considering certain typical reactions individually. The reaction between hydrogen and oxygen is separated from the rest on the grounds that this reaction is now fairly thoroughly understood and our knowledge is reasonably accurate and complete. The action between carbon monoxide and oxygen is also treated as a unit, but in a different manner, as it is considered that there are as yet a number of unfilled gaps in our knowledge. The remainder of this part surveys the theoretical and experimental evidence relating to the reactions between hydrocarbon vapours and oxygen.

The second, and by far the largest part deals with the immense field of flame propagation. Developments in the field of burner design have been both wide and rapid since the first book under this title and the whole subject has been well covered, especially the part dealing with the structure of flames and cool flames. Part III follows logically on from Part II, and is treated with the same completeness.

Part IV could with advantage be considerably extended. The major part of it consists of a discussion on internal combustion engines while industrial heating is dismissed in four pages within which occurs the statement that 'A discussion on the design and operation of industrial furnaces is outside the scope of this book.' This may well be true and, if so, this chapter might easily have been omitted. It merely whets the appetite and provides for the satisfaction of the same, a somewhat sketchy bibliography. If industrial furnaces are outside the scope of a book of this type, it seems unnecessary to cover a subject such as internal combustion engines about which there seems no dearth of published work.

The book contains a number of appendices consisting entirely of data conveniently set out in tabular form. This data will prove useful. As the authors' preface indicates, the book is a summary of the theoretical and practical knowledge on each subject. Where the authors consider that the subject has not reached finality, they give the expermental evidence and their own criticisms and also a critical analysis of the theory as it now stands. In giving references, they have avoided parochialism and so the bibliographies range widely.

It can be well and worthily recommended for detailed study to anyone whose work lies in its direction, and anyone whose interests lie in a similar direction will find it interesting.—A.W.

PHYSIOLOGY AND PHARMACOLOGY FOR PHARMACEUTICAL STUDENTS. By H. H. Barber. 3rd Edition. London. Bailliere, Tindall and Cox. 1951. Pp. X +622. 25s.

This is a most sensible and adequate book which may without hesitation be recommended to pharmaceutical students, for whom it has been specially written. Dr. Barber has an unobtrusively easy manner which will no doubt help many a lame dog over the stiles set by his examiners, and this is particularly welcome in an introductory manual at a time when so many books of similar purpose are losing all sense of converse with another mind, by the mere pressure of their included facts. The impersonal approach of more advanced textbooks is not the best means of introducing the subject to a beginner.

For its advantages in this respect therefore it is perhaps a pity that the title of the book should have been so specifically worded. Pharmacists, whatever the vagaries of their subsequent syllabuses, do not differ so very much in their requirements at the stage with which this book is concerned, from veterinary, dental, agricultural or even medical students: all, in their first approach to the subject, want a readable introductory account of the blood and circulation, respiration, the digestive system, and so on, which is exactly what this book provides. It seems a pity then that an over-modest title should prevent a good book of its kind from reaching a wider public.

The wisdom of including practical sections in a primarily theoretical textbook is debatable; to the reviewer it is a matter for regret that in this case one-fifth of the whole text should have been so used. It is to be supposed that students of the book will also have access to laboratories, which implies their use of the laboratory's range of apparatus—often most peculiar and time-honoured—and that they will be subjugated to the whims of lecturers, often pernickety and eccentric, and always strongly minded to conduct their own affair in their own way. All too frequently that way will not be the way of Dr. Barber's carefully planned exercises. One hundred pages so gained might be turned to much better account by devoting them to an amplification of the main text.

It is always to easy to find fault with biochemical sections, for new discoveries are bound to jump the author's pen even as he writes; but quite apart from questions of fact there are some faults of order and balance here which are less readily excusable. Adenylic acid, for instance, is encountered first on p. 108, but the reader has to wait until p. 391 for his first general account of nucleic acids and the nucleotides, which are then presented very sketchily under the unlikely sub-heading 'Chemical Composition of Urine'. Indeed, Dr. Barber is not at ease among his sub-titles, and in his rather lazy chapter on 'Enzymes', where, among other blemishes the enzymes are arranged alphabetically, he contrives to gather them under the general heading of 'Coenzymes' One wonders also what even the most intelligent student will gather from the account of the citric acid cycle on p. 111, in view of the scant attention given to the compounds involved in the more chemical sections of the book. Surely one should either omit the detail altogether, or else expound the relationships in a less esoteric way.

It is, however, the penalty incurred by a good book that we should wish to see it better, and such questions of presentation are undoubtedly troublesome, yet of paramount importance.

A few errors of fact may be briefly noted. 100 per cent on the Haldane scale for blood haemoglobin is now believed to be equivalent to a value of 14.8 g. of haemoglobin per 100 ml. (*see* King, 'Micro-analysis in Medical Biochemistry'); the formula for coenzyme II (p. 274) is not as stated in the text; the account of fat absorption (p. 351) is incomplete without reference to the possible absorption of neutral fat in sufficiently finely divided form; while finally it is perhaps time now, even in accounts given in introductory textbooks, to discontinue the oversimplified picture of nucleic acid structure developed by Levene. It should be possible to give an indication of their recently appreciated complexity without greatly encumbering the text.—F.N.M.

U.S. Chemical Industries Exposition

SOME latest products on show at the 23rd exposition of chemical industries in New York from 26 November to 3 December included many new products and equipment. A newly developed centrifuge incorporating a return flow principle was said to enable it to accomplish separations not possible with other types of equipment. The separation of sludge from lub. oil, the classification of pigments, recovery of alum and in concentrating and washing precipitates, were some of the fields in which it had operated successfully, it is reported.

Exhibited for the first time in the U.S was a multi-stage counter-current extractor designed for making antibiotics.

Specially developed for food and chemical processing was an angle type disintegrator of sanitary construction. Filter fabrics made of resistant materials such as 'Nylon,' 'Orlon', 'Vinyon' and 'Dynal' were also shown.

• HOME •

Acknowledgement

In our issue of 24 November, page 687, we published an account of a method suggested for the rapid determination of TiO_2 in ilmenite ores by W. A. Tooke, Chief Chemist of the Malaya Geological Survey. This account was taken from 'Colonial Geology and Mineral Resources', Vol. 2, No. 1, 1951 (page 60), recently published by H.M. Stationery Office (price 5s.).

To Intensify Drive

The Minister of Supply (Mr. Duncan Sandys), the steel industry and the scrap merchants have decided, in view of the gravity of the steel scrap situation, to intensify the scrap drive in 1952.

Discussions have taken place between the Minister, officials of the scrap drive organisation of the Iron and Steel Industry, and the president, chairman and members of the Management Committee of the National Federation of Scrap Iron, Steel and Metal Merchants. They are investigating ways and means of making even more effective the wide-scale drive which has been undertaken since the beginning of this year by the iron and steel industry in collaboration with the scrap merchants' industry.

Lesson on Rubber

On 10 December the Monsanto Chemicals, Ltd., of Allington Street, London, S.W.1, held a staff meeting in the Royal Empire Society Building, Northumberland Avenue, London. In connection with this a small display was arranged of goods in which Monsanto chemicals were used. Included in this display was an exhibit prepared by the British Rubber Development Board. The exhibit showed rubber seeds, tapping knives, and a latex collecting cup, as used by the native workers on the estates, and a small exhibit entitled 'Lesson on Rubber'. In addition a selection of small household articles made from rubber was shown, including a rubber torch, shampoo spray, nail brush, kneeling mat, soap saver, door stop, hot water bottle, and many other items.

The British Rubber Development Board's publications—'Latex Foam in the Home' and 'New World Round the Corner' were also available.

Seek Legislation

Bootle Council on 5 December approved a Fire Brigade Committee resolution authorising the Town Clerk to communicate with the Secretary of State and the Association of Municipal Corporations, with a view to the introduction of legislation to enable local authorities to control effectively the storage of carbon bisulphide and other dangerous goods not at present covered by the Petroleum and Explosive Acts.

November Steel Production

British steel production in November was at the annual rate of 16,437,000 tons compared with 15,629,000 tons in October and 17,472,000 tons in November, 1950.

The output of pig iron was at an annual rate of 10,194,000 tons compared with 9,865,000 tons in October and 10,042,000 tons a year ago.

Courses Completed

Eleven foreign students—two Dutch, four French, one German, one Swedish and three Swiss—have completed a vacation course in various divisions of the Dunlop organisation this year. Their work included chemistry, physics, and engineering. Three of them held three of the nine bursaries offered by Dunlop to students from foreign universities who might have been unable to take advantage of the scheme for lack of funds.

Collapsible Tube Service

Under the auspices of the Collapsible Tube Manufacturers' Association, a Packaging Advisory Committee for Food and Other Industries has been formed. Facilities for information and guidance are available to collapsible tube users and potential users, in respect of technical, commercial, chemical, and scientific problems.

The following firms are represented on this advisory committee: Betts & Co., Ltd.; John Dale, Ltd.; Flexile Metal Co., Ltd.; Invicta Foil & Cheswright & Nicholls, Ltd.; H. G. Sanders & Sons, Ltd.; Universal Metal Products, Ltd.; and Venesta, Ltd.

All inquiries should be addressed to the Secretary, Collapsible Tube Manufacturers' Association, 24 Portland Place, London, W.1.

OVERSEAS

New Research Laboratory

As a further move in the expansion of its chemical research programme in Canada, Monsanto Canada Limited has completed arrangements for the erection of a new research laboratory and pilot plant on its Ville la Salle plant site. Construction is scheduled to begin within the next few weeks on the structure which, when completed, will more than double this company's research facilities. Costs of the building and equipment have been estimated at $400,000.

May Exceed Consumption

The B. F. Goodrich Company's president, Mr. John Collyer, recently estimated that total world output of crude and synthetic rubber next year should be about 2,900,000 long tons, while world consumption would be less than 2,500,000 long tons. This would allow 400,000 long tons for stockpiling.

U.S. Latex Boom

Production of synthetic rubber latex in the U.S. at the rate of 30,000 tons a year has prompted the U.S. Government to stop stockpiling natural rubber latex. It started stockpiling 10 months ago, but with a probable yearly production of 50,000 tons of synthetic latex within the next 12 months it is likely to have all the latex it needs in the foreseeable future, and will probably sell out present stocks to industry—not a simple matter as synthetic latex is much cheaper than the natural product.

Korea Sells Tungsten

Korea possesses some of the world's largest tungsten mines, and even though fighting has caused some of them to change hands more than once, the Koreans are still exporting the ore. All of it goes to the U.S., at the rate of 200 tons monthly.

Japanese Fertilisers

The Government of Japan has agreed to permit the export of 200,000 tons of chemical fertiliser for the fertiliser year ending on 31 July, 1952, an increase of 100,000 tons over the previous year. This will include 100,000 tons of nitrogenous fertiliser and 100,000 tons of superphosphate of lime and will be for export to Formosa, Korea, Ryukyus Islands, and the Phillipines.

Soda Ash Replacement

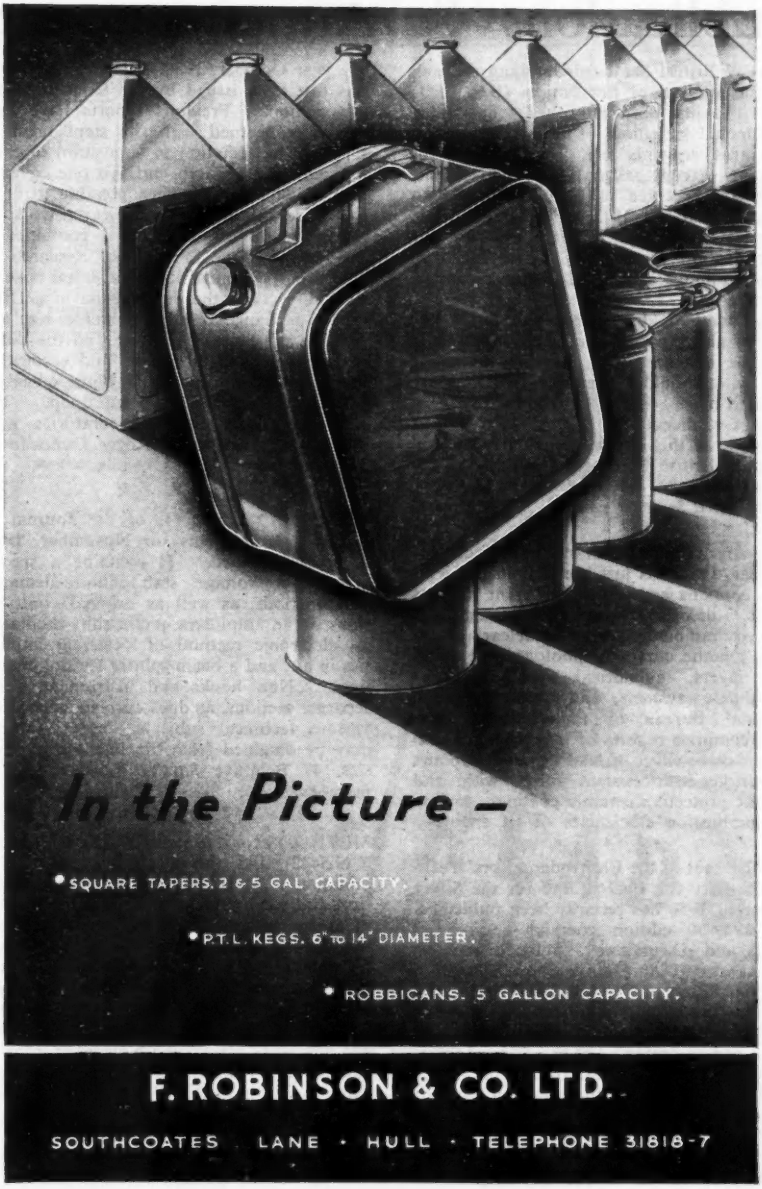
Experiments on the replacement of soda ash by cheaper sodium sulphate in glass-making are being carried out at the Central Glass and Ceramic Institute of Calcutta. Sodium sulphate or salt cake is plentiful in parts of India, while India's soda ash requirements amount to 40,000 tons per annum, most of it imported. Sodium sulphate is already used to a very limited extent in the manufacture of white glass. It has been found that it can replace soda ash in certain glasses—particularly amber glass, used in making pharmaceutical bottles, ampoules, etc.—to a substantial extent.

Japan Now Ranks Third

During the past five years, rapid strides have been made in the production of penicillin in Japan and this country now ranks third among the leading producers. Production for 1951 is estimated at 12,000 billion units as compared with 7,495.5 billion units in 1950. Output in the previous years was as follows: 1946—48 billion units; 1947—13.8 billion units; 1948—307.4 billion units; and 1949—448.8 billion units.

New U.S. 'Metals'

The President of Knapp Mills Incorporated of America has recently announced that after years of experimentation and development, his company is now ready to offer American industry two new metals which can drastically reduce the monumental waste caused annually by sulphuric acid, the U.S. *Journal of Commerce* reports. The first of the new 'metals' is called *ferrolum*, and it is made by inseparably bonding lead and steel in such a way that the finished product is described as combining lead's immunity to sulphuric acid with the strength of steel. The second 'metal' *cupralum*, which is made by inseparably bonding lead and copper, retaining the best features of both metals. In addition to the use of the two 'metals' for supplanting inadequate materials in present use on standard equipment, it is expected that they will have widespread use throughout nuclear industries for preventing the escape of harmful radiation.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Publications & Announcements

A NEW British Standard outlining methods for the analysis of raw copper (B.S. 1800: 1951) has just been published. This Standard includes methods of analysis (sampling, apparatus, reagents and procedure) for the elements (except oxygen) for which definite limits are specified in B.S. 1035-40, 'Raw Copper', and B.S. 1172-74, 'Deoxidised and Arsenical Coppers'. A method for the determination of sulphur is also included, although limits are not specified in the above standards.

The methods have been found to give reliable and reproducible results and, while in some instances they may appear to be lengthy, it should be realised that they are intended to be 'referee' methods to be used in cases of dispute.

Copies of this standard may be obtained from the British Standards Institution, Sales Department, 24 Victoria Street, London, S.W.1, price 5s. post paid.

* * *

THE Journal of the Franklin Institute for October, 1951, has just been published. This issue contains articles on recurrent mirages on the Gulf of California, the slow neutron-induced radioactivities of nuclear explosions, quantic curves of photographic emulsion layers, cylindrical and rotational co-ordinate systems, and notes from the National Bureau of Standards. These notes comprise reports of investigations into the corrosive effect of lead bromide vapours on various heat-resistant alloys with and without protective ceramic coatings, and on the combustion efficiencies of jet engines.

* * *

THE Journal of the Electrodepositors' Technical Society for 1949-50 and for the Silver Jubilee of 1950 has recently been published. The 1949-50 edition contains reproduced papers and discussions. Subjects such as 'The Disposal of Plating Shop Effluents', and 'Corrosion of Cadmium and Zinc Coatings in Electrical Equipment' are included. The Silver Jubilee edition contains reports of the papers presented at the Silver Jubilee Conference held at Eastbourne on 19-22 April, 1950, as well as the president's speech at the dinner.

* * *

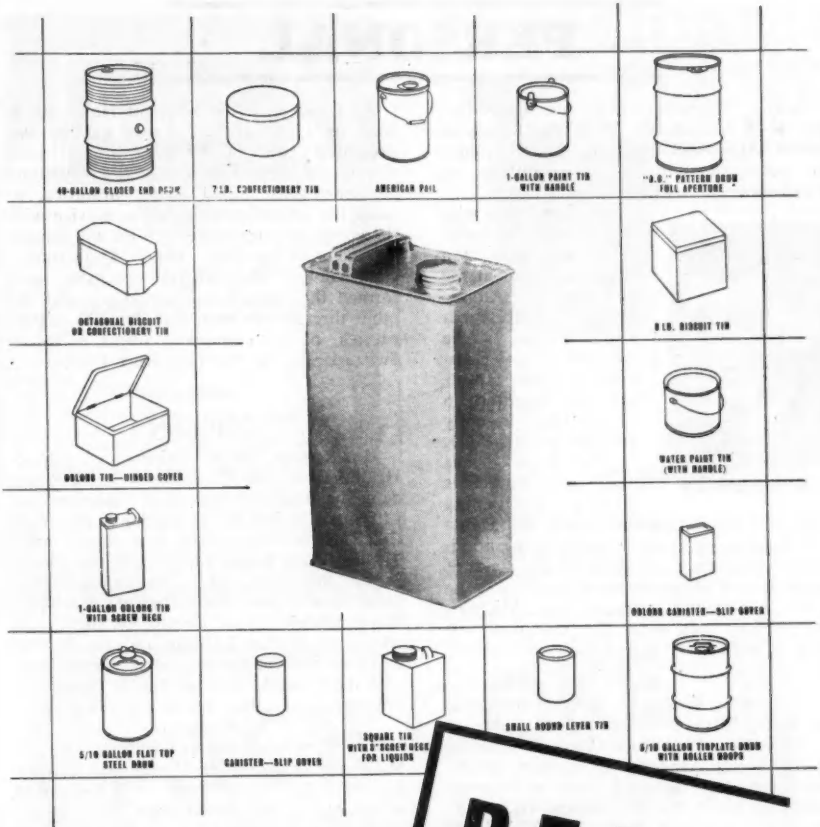
THE THIRD Annual Report of the British Gelatine and Glue Research Association for the year October, 1950, to September, 1951, has just been issued by the Council of the Association. Previous reports have been mainly concerned with the steps taken to place the Association in a position to carry out scientific research, but this one covers a year in which it has been possible to begin a considerable amount of research work. A brief account of the work is contained in the report of the Director of Research included in the Annual Report. It has covered such subjects as the deionisation of gelatine by ion-exchange resins; the shape, size and molecular weight of gelatine and the determination of its end-group; and studies of the organic constituents of bone. Analytical studies are also reported upon. The Research Association's laboratories were officially opened by Sir Roger Duncalfe on 29 November.

* * *

VOLUME 28, No. 11, of the Journal of Scientific Instruments for November, 1951, is now published. It contains a special article on voltage stabilisation—demands and methods, as well as original contributions on an amplidyne phase shift oscillator, an electronic method of detecting impurities in air, and a beam-splitter for collimated light. New books and instruments form separate sections, as does correspondence on various technical subjects. The Journal may be obtained from the Institute of Physics, 47 Belgrave Square, London, S.W.1, price 8s.

* * *

METHODS for the sampling of ferro-alloys (CN.5442) and the absorptiometric determination of small amounts of chromium in iron and steel (CN.5443) are among the list of draft standards in the November issue of the British Standards Institution Monthly Information Sheet. Draft standards are liable to modification before adoption and comments are welcomed. Besides a summary of new standards issued, amendments and new work started the November information sheet gives a list of new overseas standards available in the BSI library and draft standards received from the British Commonwealth and the Argentine, Belgium, Denmark, Germany, Finland, Italy and Israel.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PERSONAL

Innoxa (England), Ltd., announce that DR. K. B. ALBERMAN, M.A., Ph.D., son of MR. A. ALBERMAN, managing director, joined the technical staff of the company on 1 November.

Dr. Alberman

Dr. Alberman, who is 25 years old, spent nearly two years as a scientific officer at the Harwell Atomic Energy Research Establishment. He returned to Cambridge for post-graduate research in 1949 and recently qualified for his Ph.D. 'My hope', says Mr. Alberman, 'is that my son's training will help, in conjunction with the Debat Laboratories in Paris, to increase the application of scientific method to the field of cosmetic and allied products'.

Mr. Alberman's younger son, Michael, has already been with the company for three years and is now on the administrative staff.

When King Gustav of Sweden presented the Nobel Prizes for 1951 at Stockholm on 10 December, PROFESSOR ARNE WESTGREN, of the Royal Academy of Science, Stockholm, presented the work done by PROFESSORS EDWIN M. MCMILLAN and GLENN T. SEABORG which won them the 1951 Nobel Prize for chemistry. It was because of their discoveries in the realm of transuranic elements that McMillan and Seaborg were chosen by the Royal Academy as prize-winners, he said. They and their fellow-workers reported in 1940 that when neptunium disintegrates it gives rise to an Element 94. This was given the name 'plutonium' and played an important part in the development of the atomic bomb. After this war-like problem had been solved Seaborg, as leader of a group of research workers, completed the studies of the transuranic elements, and in doing so, said Professor Waller: 'He has written one of the most brilliant pages in the history of the discovery of chemical elements'.

At a dinner at the Midland Hotel, Bradford, on 11 December, a cigar cabinet was presented to MR. W. P. WALKER, sales director of Sandoz Products, Ltd., dyestuffs and chemicals, Canal Road, Bradford, to mark his retirement from active service with the company after 40 years. He will remain a director of the firm. MR. C. F. JACOTTET, chairman of the English company, performed the presentation ceremony, and the other directors present were MR. W. STAUFFACHER, of the company's works in Basle, Switzerland, and SIR GORONWY OWEN.

Obituary

MR. SAMUEL HEAP, chairman of Samuel Heap & Son, Ltd., Caldershaw Mills, Rochdale; the Boarshaw Raising & Finishing Co., Ltd.; and the Silk Street Raising & Finishing Co., Ltd., Newton Heath, Manchester, aged 71, died at his home, Seymour House, Drake Street, Rochdale, on 9 December. Mr. Heap was a past chairman of the Spun Rayon Fabric Dyers' Group; on the Council of the Shirley Institute and the Society of Dyers and Colourists, and was associated with the Confederation of Textile Dyers and Finishers and other textile organisations.

MR. CHARLES HENRY PARKER, F.C.S., M.I.Fuel, a director of Coalite and Chemical Products, died suddenly on 8 December at the age of 80. Mr. Parker was consultant to this company for more than 25 years and was responsible for the original work on the 'Parker' retort which was the foundation of the present retort for low temperature carbonisation. He was also chairman of Fordham Pressings.

The death took place on 12 December, after a short illness, of PROFESSOR HENRY STANLEY RAPER, F.R.S., Dean of the medical school and Professor of Chemical Physiology at the University of Manchester. He was due to retire, at the age of 69, at the end of this month.

Professor Raper was made a Fellow of the Royal Society in 1929 for his work on fats and carbohydrates and served on the committee.

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APPLICATIONS are invited from **CHEMISTS** for a progressive position in a large **INDUSTRIAL RESEARCH LABORATORY** in the South of England, to study problems connected with the manufacture and use of detergents. The successful applicant should have a good Honours Degree or its equivalent and preferably some experience in the detergent field. The initial salary will be commensurate with qualifications and experience. The Company operates a Pension Scheme. Apply, in writing, to **BOX NO. C.A.3080, THE CHEMICAL AGE,** 154, Fleet Street, London, E.C.4.

ASSISTANT RESEARCH MANAGER required by the Division of Atomic Energy (Production), Research and Development Branch, Windscale Works, Sellafield, Cumberland, to be responsible for a group engaged on applied research, mainly in the field of inorganic and radio-chemistry, but including a section working on problems of Organic Chemistry.

Candidates must possess a first or second Honours Degree in Chemistry, or equivalent qualifications. Experience in industrial research is essential.

Salary will be assessed according to the qualifications and experience within the range £960-£1,295 per annum. The post will carry F.S.S.U. benefits. A house will be available within a reasonable time for the successful candidate, if married. Applications to **MINISTRY OF SUPPLY, D.At.En.(P), RISLEY, Nr. WARRINGTON, LANCS,** quoting reference 278.

CHEMIST required by the **DIVISION OF ATOMIC ENERGY (PRODUCTION)**, Risley, nr. Warrington, to interpret basic chemical research to engineers engaged in the design of chemical plants and to advise on the design of these plants.

Candidates must have either an Honours Degree in Chemistry, Physics or Chemical Engineering, associateship or corporate membership (as appropriate) of one of the recognised professional institutes or institutions or equivalent qualifications. They must have had at least three years' approved experience in a chemical factory or industrial laboratory and, preferably, have had experience n chemical plant design and operation and post-graduate research.

Salary will be assessed according to qualifications and experience, within the range £670 to £860 per annum (if over 30) and according to age, within the range £570 (at age 26) to £645 per annum (if under 30). There is a voluntary Superannuation Scheme. Applications to **MINISTRY OF SUPPLY, D.AT.EN.(P), RISLEY, Nr. WARRINGTON, LANCS.,** quoting reference 282.

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CONTRACTS MECHANICAL ENGINEERS required to deal with the organisation and planning of Refinery or Chemical Plant through all stages of mechanical design. University, Engineering or Chemistry Degree preferred. Duties to be in London, with travel at intervals to sites. Age limit, 30-50. Salary according to experience and qualifications. Superannuation Scheme. Apply **BOX NO. 46, c/o BROWNS, 37, TOTHILL STREET, S.W.1.**

EXPERIMENTAL OFFICERS AND ASSISTANT EXPERIMENTAL OFFICERS in various Government Departments. The Civil Service Commissioners invite applications for permanent appointments to be filled by competitive interview during 1952. A closing date for the receipt of applications earlier than December, 1952, may eventually be announced either for the competition as a whole or in one or more subjects. Interviews will be held shortly after the receipt of the completed application form and successful candidates may expect early appointments.

The posts are divided between the following main groups and subjects:—

(*a*) Mathematical and Physical Sciences;
(*b*) Chemistry and Metallurgy;
(*c*) Biological Sciences;
(*d*) Engineering Subjects; and
(*e*) Miscellaneous (including, e.g., Geology, Library and Technical Information Services).

AGE LIMITS—For Experimental Officers, at least 26 and under 31 on December 31st, 1952, for Assistant Experimental Officers at least 18 and under 28 on 31st December, 1952. Extension for regular service in H.M. Forces.

Candidates must have obtained, or be taking examinations during 1952 with a view to obtaining, the Higher School Certificate with Mathematics or a Science subject as a principal subject, or the General Certificate of Education in appropriate subjects, or the Higher National Certificate or other specified qualifications. Candidates without such qualifications may be admitted exceptionally on evidence of suitable experience. Candidates over 20 will generally be expected to have higher qualifications.

Inclusive London Salary Scales:—
Experimental Officer, £575-£725 (men); £485-£600 (women).
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Somewhat lower rates in the provinces.

Further particulars and application forms from the **CIVIL SERVICE COMMISSION, SCIENTIFIC BRANCH, TRINIDAD HOUSE, OLD BURLINGTON STREET, LONDON, W.1,** quoting S94-95/52. Completed application forms should be returned as soon as possible. 13775/120/EH

KELLOGG INTERNATIONAL CORPORATION. Engineers with University Degree, and membership in one of the professional institutions, required for Refinery and Chemical Plant projects. Executive status, good commencing salary. Duties would be organisation and planning of project from finalisation of process design through all stages of mechanical design to construction stage. Arrangement of plot plan, specifications for size and type of equipment, instruments, etc., calculation of pipe sizes, arrangement of flow sheets and transmittal of all information to draughting office. Selected candidates would work in London office, travelling at intervals to job sites. Fullest details may be sent in strictest confidence to **PERSONNEL OFFICER, STONE HOUSE, BISHOPSGATE, LONDON, E.C.2,** and should include age, education, qualifications, experience and present salary. All applications will be acknowledged.

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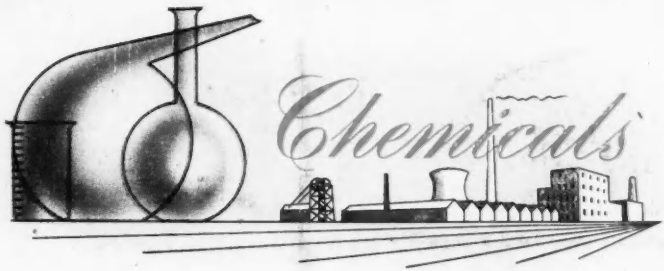

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